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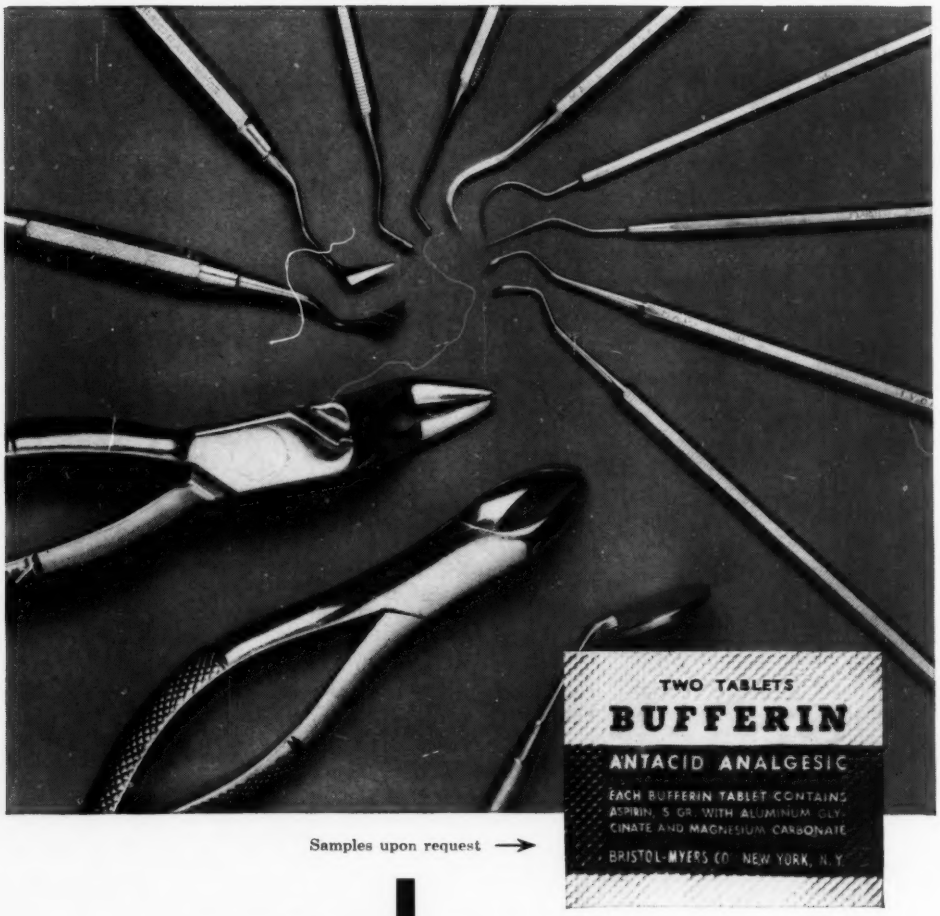
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JOURNAL OF ORAL SURGERY, ANESTHESIA AND HOSPITAL DENTAL SERVICE

Fred A. Henny, D.D.S., Editor
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U. S. Navy Dental Corps special issue

This month the newly named JOURNAL OF ORAL SURGERY, ANESTHESIA AND HOSPITAL DENTAL SERVICE departs from its long established publication procedure by devoting the entire issue to articles submitted by authors associated with a particular facility. The nine authors who prepared the seven scientific articles and the seven authors who submitted the six case reports are all officers of the Dental Corps of the United States Navy. It is anticipated, therefore, that this issue rightly will be recorded as the United States Navy issue.

It is the hope of the editor that the precedent herewith established by the Navy will form a worthwhile pattern for other facilities and agencies. In fact, plans are well under way for the publication of special issues, the contents of which will be prepared by other groups of associated authors. Although none of the 13 reports deal with conditions specific to the naval service, that fact makes them more valuable to dentists in civilian practice as the conditions described are common to both civilian and military patients.

The JOURNAL OF ORAL SURGERY, ANESTHESIA AND HOSPITAL DENTAL SERVICE welcomes the opportunity of devoting the initial issue under its new name to U. S. Navy Dental Corps officers. It takes this occasion to express publicly its deep appreciation to the contributing authors: Henry H. Scofield, D.D.S., M.S., Commander; Donald E. Cooksey, D.D.S., M.S., Captain; Robert A. Middleton, D.D.S., M.S., Captain; Walter W. Crowe, D.D.S., Captain; John Paul Jarabak, D.D.S., Captain; Raymond F. Huebsch, D.D.S., Captain; Theodore A. Lesney, D.D.S., Captain; Kimble A. Traeger, D.M.D., Commander; Louis S. Hansen, D.D.S., M.S., Captain; Anthony P. Giammusso, D.D.S., Commander; W. Basil Johnson, D.D.S., Captain; Harold G. Green, D.D.S., Captain; Robert A. Colby, D.D.S., Captain; Roger G. Gerry, D.M.D., Captain; Frederick T. Wigand, D.D.S., M.S., Captain, and Wilbur N. Van Zile, D.D.S., Captain. The JOURNAL also wishes to express its appreciation to the following authors whose papers, because of space limitations, will be published in later issues: William R. Staples, D.D.S., Commander, and Jerome C. Stoopack, D.D.S., Captain.

The blue (Jadassohn-Tièche) nevus: a previously unreported intraoral lesion

■ *Henry H. Scofield, D.D.S., M.S., Bethesda, Md.*

The blue nevus, although seen rather frequently in the skin, has never been reported as occurring within the oral cavity. Most nevi of this type are present at birth and remain unchanged throughout life. The typical blue nevus is a sharply circumscribed, smooth, firm, round or oval, slightly elevated papule which seldom exceeds 1 cm. in diameter. Malignant alterations are extremely rare. Two cases of intraoral nevi are described.

In 1906, Tièche,[1] at the suggestion of Professor Jadassohn, described a series of small, sharply defined, blue to blue-black spots on the face and extremities of 17 patients. Each spot had been present since early childhood but had undergone no appreciable change in appearance. Because of their color and clinical history, Tièche called these spots *blaue naevi* (blue nevi), although, according to Tièche, similar lesions had been described previously by Riecke and by Ribbert as chromatophoromas, and by Borst and by Kreibich as melanofibromas. These lesions have since become known as blue, or Jadassohn-Tièche, nevi.

Since Tièche's original paper, many reports of the blue nevus have appeared in the literature. In none of these, however, has the lesion been described in the oral cavity. It is the purpose of this paper to review the literature on the blue nevus and to present a report of two intraoral blue nevi, which is the first recorded occurrence of the lesion in this location.

■ *Histogenesis*

There is general agreement among those who have studied the blue nevus that the lesion is composed of true dermal melanoblasts. Sato[2] was the first to prove that the blue nevus cells are true melanoblasts by demonstrating a positive dopa reaction, a finding which has been confirmed repeatedly by others. The origin of the blue nevus cells, however, is a matter of dispute and depends on whether melanoblasts are all of ectodermal origin, that is, ordinary basal or dendritic cells of the epidermis, or whether there are true melanoblasts of mesodermal origin. Tièche,[1] McCarthy,[3] Becker, Sr.,[4] and Montgomery and Kahler,[5] have favored

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Commander, Dental Corps, U. S. Navy. Head, oral pathology division, U. S. Naval Dental School, National Naval Medical Center.

1. Tièche, Max. Uber benigne Melanome ("Chromatophorome") der Haut—"blaue Naevi." Virchows Arch. path. Anat. 186:212 Nov. 1906.

2. Sato, K. Beitrag zur Kenntnis des "blauen Nävus." Dermat. Wschr. 73:1073 Oct. 1921.

3. McCarthy, Lee. Histopathology of skin diseases. St. Louis, C. V. Mosby Co., 1931, p. 411.

4. Becker, S. W. Melanotic neoplasms of the skin. Am. J. Cancer. 22:17 Sept. 1934.

5. Montgomery, H., and Kahler, J. E. Blue nevus (Jadassohn-Tièche): its distinction from ordinary moles and malignant melanoma. Am. J. Cancer 36:527 Aug. 1939.

the mesodermal origin of the blue nevus cell. In support of this theory Montgomery and Kahler pointed out that in 36 of the 38 instances of blue nevi which they studied histologically they were unable to demonstrate any morphologic connection between the blue nevus cells and the epidermis. Furthermore, these authors stated, "the morphologic appearance of the blue nevus cell is that of a connective tissue cell and not that of an epidermal cell."

Ito[6] also stated that he favored the mesodermal origin of the blue nevus cell. Using special staining technics, he demonstrated an intimate association between the blue nevus cell and the perineural connective tissue and concluded that the blue nevus cell originates from the endoneurium or perineurium.

Allen[7] and Allen and Spitz[8] expressed their belief in the neurogenic origin of the blue nevus, principally for structural reasons. In their view, the blue nevus fits closest to the lesion corresponding to the pigmented neurofibroma.

Masson[9,10] and others, however, have stated their belief that the blue nevus cell is of ectodermal origin. Masson reported two cases in which a blue nevus was associated with a dermal myelinated plexiform neuroma, and described a gradual transition between the Schwann cells of the neuroma and the melanoblasts of the blue nevus. He concluded that the blue nevus originates from the neurilemma which is derived from the ectodermal neural crest.

Montgomery[11] and Becker, Jr., (cited by Montgomery and Dorsey)[12] have stated that the blue nevus cells may originate from the neural crest just as do the pigment-producing cells of the epidermis. But they suggested that the blue nevus cell represents one that has failed to migrate as far as the epidermis, and that because of its location in the dermis, where the tissue is less compact, the cell has a chance to become larger than the dendritic cells of the epidermis.

■ *Clinical Findings*

There are few statistics available relative to the incidence of the blue nevus among other pigmented nevi. Stegmaier and Montgomery[13] found no blue nevi among 100 pigmented nevi excised at random from 450 children, and Pratt[14] reported none among 879 white and 217 Negro infants four to eight days old. A review of the literature, however, suggests that the lesion may occur more frequently than ordinarily supposed. Tièche collected his 17 cases in eight months. Montgomery and Kahler collected their 65 cases in an 11 year period. Dorsey and Montgomery's[12] paper was based on an analysis of 200 blue nevi, and one of the authors (Montgomery) mentioned that he had seen more than 500 patients with the condition, in half of which the diag-

6. Ito, M. Studies on melanin. XI. Further contribution on pigment-bearing cells in Mongolian spot and blue nevus. Tohoku J. Exper. Med. 54:181 June 25, 1951.

7. Allen, A. C. Reorientation on histogenesis and clinical significance of cutaneous nevi and melanomas. Cancer 2:28 Jan. 1949.

8. Allen, A. C., and Spitz, S. Malignant melanoma; clinicopathological analysis of criteria for diagnosis and prognosis. Cancer 6:1 Jan. 1953.

9. Masson, P. Neuro-nevi "bleu." Arch. "de Vecchi" anat. pat. 14:1, 1950.

10. Masson, P. Névrome myélinisé dermique associé à un naevus bleu. Schweiz. med. Wschr. 77:1154 Nov. 1, 1947.

11. Montgomery, H. Benign and malignant dermal neoplasms. J.A.M.A. 150:1182 Nov. 22, 1952.

12. Dorsey, C. S., and Montgomery, H. Blue nevus and its distinction from mongolian spot and nevus of Ota. J. Invest. Dermat. 22:225 March 1954.

13. Stegmaier, O. C., Jr., and Montgomery, H. Histopathologic studies of pigmented nevi in children. J. Invest. Dermat. 20:51 Jan. 1953.

14. Pratt, A. G. Birthmarks in infants. A.M.A. Arch. Dermat. & Syph. 67:302 March 1953.

nosis was proved histologically. These series together with individually published reports bring the recorded cases to about 300.

Most blue nevi are present at birth or appear in early childhood, and persist unchanged throughout life. A review of the clinical data from two large series of blue nevi revealed no family history of the disease nor evidence of racial predilection, although there was a slightly higher incidence in females in the ratio of 3:2.[5,12]

The blue nevus occurs most frequently about the face and on the dorsa of the hands and feet. It is usually a single lesion, although multiple blue nevi in the same patient have been reported, and occasionally large plaques have been described.[12,15] The typical blue nevus appears as a sharply circumscribed, smooth, firm, round to oval, slightly elevated papule which seldom exceeds 1 cm. in diameter. The majority of the lesions are blue or bluish-black in color, although combinations of blue, gray, gray-black, brown, brown-blue and yellow have been described. The color of the blue nevus is due to the presence of melanin within its cells. The variation in color is related to the depth of the cells in the dermis and to the presence or absence of melanin in the cells of the overlying epidermis.[12]

■ *Histopathology*

Histologically, the typical blue nevus is composed of spindle-shaped melanoblasts arranged in small, irregular bundles in the middle and lower third of the dermis and separated from the epidermis by a zone of normal connective tissue. The melanoblasts have long, thin, bipolar, occasionally branching processes which are not readily apparent in hematoxylin and eosin sections, but may be demonstrated by staining with silver nitrate and counterstaining with hematoxylin. Most of the melanoblasts contain finely granular, dark brown melanin, which is evenly distributed throughout the cytoplasm. In cross section many of the nuclei are surrounded by a clear halo with the pigment occupying the peripheral portion of the cell. Occasionally the cell groups extend into the subcutaneous tissue or close to the epidermis. Less frequently the cells form one or more large masses around the sweat ducts, sweat glands, cutaneous blood vessels and nerves, and hair follicles.[12] Within and beside the cell bundles are varying numbers of chromatophores, which are larger than the melanoblasts, lack the fine, wavy, bipolar processes, and contain coarser granules of pigment. There is usually no increased pigmentation of the overlying epidermis.

Many of the nonpigmented cells show definite pigment granules when the silver nitrate-hematoxylin stain is employed. In Formalin-fixed tissue the pigment may be proved to be melanin by the fact that it gives a negative reaction for iron, bleaches with hydrobromic acid, and stains dark green when the ferrous ion uptake technic recently described by Lillie[16] is employed.

As the blue nevus ages it tends to undergo fibrosis with a reduction in the number of melanoblasts and chromatophores. This change was described by

15. Upshaw, B. Y.; Ghormley, R. K., and Montgomery, H. Extensive blue nevus of Jadassohn-Tieche; report of case. Surgery 22:761 Nov. 1947.

16. Lillie, R. D. Ferrous ion uptake; a specific reaction of the melanins. A.M.A. Arch. Path. 64:100 July 1957.

Tièche in his original article and has been reported by others.[12] Fibrosis occurs most frequently in patients past 50 years of age and probably represents a regressive change.[5] Fibrotic change in a blue nevus may lead to an erroneous histologic diagnosis of dermatofibroma or subepidermal fibrosis unless special stains are used to demonstrate the presence of melanin in the cells.

Allen[7] and Allen and Spitz[8] described a benign variant of the blue nevus which because of its rich cellularity and abundant melanin pigment may be misdiagnosed as a melanosarcoma. The cells of this lesion show no significant anaplasia, and mitotic figures are almost always absent. A characteristic feature of the cellular blue nevus, however, is that in cross section the fasciculi of melanoblasts are surrounded by a clear zone giving the illusion of metastasis in lymphatics, whereas actually they represent artifactitious shrinkage and cleavage of the cell bundles. The authors observed four instances in which this cellular type of blue nevus gave rise to metastasis in lymph nodes. In none of the instances was there evidence of recurrence or further metastasis after local excision although one patient had been followed for 14 years.

McWhorter and Woolner[17] reported two cases of cellular blue nevi in which the patients were living without evidence of recurrence or metastasis 11½ and 13 years respectively after local excision of the lesions. In Dorsey and Montgomery's series there were three instances of the cellular blue nevus in each of which there was metastasis in a lymph node. Two of the patients were alive without evidence of recurrence or metastasis 3 years and 13 years respectively after local excision, but the status of the third patient was not mentioned.

In commenting on these cellular blue nevi, Allen and Spitz stated:

> Utterly paradoxical as it may sound, there is reason to believe that such isolated metastases from this relatively common type of blue nevus are not of the order of gravity augured by metastases from melanocarcinomas.

Cases have been reported in which blue nevus cells and ordinary pigmented nevus cells were intermingled in the same lesion, or in which there were junctional changes in the epidermis overlying a blue nevus.[5, 17, 18] Montgomery and Kahler described four cases in which ordinary pigmented nevus cells lay directly beneath the epidermis and seemingly originated from it. Deeper in the dermis among the ordinary nevus cells, long, fusiform, bipolar, pigmented, dopa-positive cells occurred singly or in bundles. In the lower third of the dermis the fusiform blue nevus cells predominated, but no definite transition from one cell type to the other could be demonstrated. Three of these lesions were diagnosed clinically as pigmented nevi, and the fourth as a blue nevus.

■ *Malignant Blue Nevus*

The blue nevus is fundamentally a benign lesion which rarely undergoes malignant change unless subjected to prolonged or repeated irritation.[5, 8, 19] A malignant blue nevus is decidedly less

17. McWhorter, H. E., and Woolner, L. B. Pigmented nevi, juvenile melanomas and malignant melanomas in children. Cancer 7:564 May 1954.

18. Broders, A. C., and Fletcher, E. M. Evidence in support of neuro-epithelial nature of moles. Am. J. Clin. Path. 3:29 Jan. 1933.

19. Jadassohn, J. Dermatologie. Wein-Bern, Weidmann and Co., 1938, p. 429.

virulent than a malignant melanoma and tends to run a protracted clinical course.[5, 20] Montgomery and Kahler found no malignant blue nevi among the 38 lesions they studied histologically. They reviewed all published reports of malignant change in a blue nevus and concluded that in only one instance was there fairly clear-cut histologic evidence of malignancy.

Allen and Spitz[8] described six cases of malignant blue nevi, in two of which the patients were dead within two years after the primary lesion was excised. Of the remaining four patients, one was alive with lymph node metastasis two years after the diagnosis was made; one was alive with multiple metastatic lesions in the axillary lymph nodes ten years after the diagnosis was made, and one was alive without evidence of metastasis six years after local excision of the primary lesion. No follow-up data were available on the sixth patient. In each of these instances there was residual histologic evidence of the original benign cellular blue nevus from which the authors assumed the malignant lesion arose and from which it could be distinguished without difficulty.

Allen and Spitz emphasized that in addition to the standard histologic characteristics of malignancy, that is, mitotic figures, pleomorphism and large, irregularly hyperchromatic nuclei, necrosis is a prominent finding and, in their opinion, a diagnostically important feature of the malignant blue nevus. In addition, the malignant cells show a strong tendency to become swollen and vacuolated, and to lose much of their spindled character so as to appear epithelial or carcinomatous.

As previously mentioned, Dorsey and Montgomery[12] described three instances in their series in which there was metastasis to the original lymph nodes. Two of the three patients were alive without evidence of recurrence 3 years and 13 years respectively after operation. The authors stated, however, that it was difficult to determine whether the three lesions should be considered similar to the four cellular blue nevi of Allen and Spitz or whether they should be labeled as malignant blue nevi.

Fisher[21] reported a malignant blue nevus in the scalp of a 27 year old white man with metastasis to the right cervical lymph nodes. The patient appeared to be free of disease six years after local excision of the primary lesion and a radical neck dissection on the right side, but subsequently subcutaneous and hepatic metastasis developed.

■ *Differential Diagnosis*

The blue nevus must be differentiated from the Mongolian spot, certain other blue, patchlike lesions, a dermatofibroma with hemosiderin (histiocytoma), a small, deep-seated hemangioma, an incipient melanoma, and localized argyria. The Mongolian spot usually appears as a solitary, nonindurated macule, 0.5 to 5.0 cm. in diameter, which varies from blue to brown in color. It is seen most frequently in the Mongolian and Negro races and is characteristically located in the lumbosacral region, although it has been reported in other regions, including the extremities, face, and palate.[22] Like

20. Andrews, G. C. Diseases of the skin, ed 4. Philadelphia, W. B. Saunders Co., 1954, p. 708.

21. Fisher, E. R. Malignant blue nevus. A.M.A. Arch. Dermat. 74:227 Sept. 1956.

the blue nevus, it is present at birth or appears shortly thereafter. Unlike the blue nevus, however, it gradually fades during early adolescence. It is generally agreed that the cells comprising the blue nevus and the Mongolian spot are identical.[3,5-7,12] In the Mongolian spot, however, the cells are fewer, they occur singly rather than in clumps or masses, and there is no disturbance of the normal connective tissue architecture.

Occasionally, diffuse, blue, patchlike lesions have been reported, which occurred principally on the face and frequently involved the sclera. These were described as "extensive blue patchlike pigmentation,"[23] "diffuse mesodermal pigmentation,"[24] and "nevus fusco-caeruleus ophthalmo-maxillaris of Ota."[25] Histologically, these lesions are very similar to both the blue nevus and the Mongolian spot. Clinically, they differ from these conditions in that they involve extensive areas of the face and sclera, usually do not appear until early adult life, and tend to become more extensive with age. It has been suggested that these bluish, patchlike lesions, the blue nevus and the Mongolian spot represent morphologic variants of a single pathologic process, and that all be included in the concept of a single clinical entity.[23]

The blue to bluish-black color of the typical blue nevus usually distinguishes it from the brownish to brownish-black junctional and intradermal nevi. In doubtful instances biopsy will clearly differentiate the lesions.

A dermatofibroma (histiocytoma) may have a bluish black appearance if large amounts of hemosiderin are present.[26] Histologic examination, however, reveals varying numbers of pigmented chromatophores in the dermis, but no elongated, spindle-shaped melanoblasts are seen. In questionable instances special staining with potassium ferricyanide will identify the pigment as iron.

A small, deep-seated hemangioma may resemble a blue nevus on initial examination. A hemangioma, however, is soft to palpation, and digital pressure will force out the blood, causing the lesion to fade.

On occasion a blue nevus will simulate the steel blue color of an incipient malignant melanoma. Since melanomas arise in pre-existing junctional nevi, there is frequently a history of a gradual darkening and increase in the size of the junctional nevus. The importance of wide excision biopsy of such a lesion cannot be overemphasized. The histologic observations are confusing only when the melanoma cells are fusiform in shape and so heavily pigmented as to obscure histologic detail.

Localized argyria is due to the deposition of reduced silver compounds in the connective tissue portion of the skin and mucous membrane such as may follow the repeated application of silver nitrate to an ulcer. The bluish, bluish-gray, or brownish color of the resultant pigmentation closely simulates that of the blue

22. Cole, H. N., Jr.; Hubler, W. R., and Lund, H. Z. Persistent, aberrant mongolian spots. Arch. Dermat. & Syph. 61:244 Feb. 1950.

23. Pariser, H., and Beerman, H. Extensive blue patchlike pigmentation. Arch. Dermat. & Syph. 59:396 April 1949.

24. Carleton, A., and Biggs, R. Diffuse mesodermal pigmentation with congenital cranial abnormality. Brit. J. Dermat. 60:10 Jan. 1948.

25. Yoshida, K. Nevus fusco-caeruleus ophthalmomaxillaris Ota. In Studies on melanin, Ito, M. Tohoku J. Exper. Med. (Supp. 1) 55:34 Feb. 9, 1952.

26. Lever, W. F. Histopathology of the skin, ed. 2. Philadelphia, J. B. Lippincott Co., 1954, p. 403.

nevus. In the skin fine, dark brown granules of silver are seen just beneath the epidermis and about the skin appendages, especially the sweat glands. In the mouth, localized argyria (amalgam tattoo[27]) may be due to the incorporation in the tissue of silver amalgam filling material, which in histologic sections is seen as minute brownish black granules in the collagen fibers of the lamina propria.[28]

■ *Treatment*

Most blue nevi need not be removed except for cosmetic purposes or unless they are located in a region subjected to repeated irritation. Should a blue nevus increase in size or begin to darken, wide surgical excision and histologic examination are mandatory.

■ *Case Reports*

CASE 1—The specimen was submitted to the oral pathology division, U. S. Naval Dental School, by Cmdr. C. R. Shea, Dental Corps, U. S. Navy. The patient was a 24 year old white man who reported for a routine oral examination. During the course of the examination a bluish pigmented area was noted on the hard palate opposite the first molar tooth. The patient was unaware of the lesion and gave no history of recent operative dentistry or oral surgical procedures.

Grossly, the specimen consisted of a Formalin-fixed wedge of mucous membrane measuring 0.8 by 0.6 by 0.5 cm. In the center of the mucosal surface there was a sharply circumscribed, slightly elevated, smooth, oval, bluish area measuring approximately 0.2 cm. in diameter.

Histologic examination revealed a section of mucous membrane and submucosa covered by stratified squamous epithelium which was normal in appearance with no evidence of pigmentation or junctional activity. Near the center of the section the mucosal surface was elevated slightly above the normal level, and within the lamina propria in this area there was a rather sharply delineated mass of loosely arranged, spindle-shaped cells with elongated, cigar-shaped nuclei (Fig. 1). Most, but not all, of these cells were filled with finely granular, dark brown pigment, which was evenly distributed throughout the cytoplasm. In cross section many of the nuclei were surrounded by a narrow, clear halo, with the pigment occupying the peripheral portion of the cytoplasm. Scattered among these cells were large cells containing coarse, densely packed granules of pigment.

For the most part the cell mass was separated from the epidermis by a narrow zone of normal connective tissue. However, a few isolated pigmented cells were seen close to the epidermis, and in sections stained with silver nitrate, individual, pigmented cells were noted in the dermal papilla (Fig. 2).

The following special staining methods identified the pigment as melanin: the ferrous ion uptake technic described by Lillie,[16] which is specific for melanin in Formalin-fixed tissue; Turnbull's blue for hemosiderin; and silver nitrate counterstained with hematoxylin. A melanin bleach utilizing hydrobromic acid was also used. The results were uniform: The Lillie stain was positive for melanin; the

27. Bell, C. D.; Cooksey, D. E., and Nickel, W. R. Amalgam tattoo (localized argyria). A.M.A. Arch. Dermat. & Syph. 66:523 Oct. 1952.

28. U. S. Naval Dental School. Color atlas of oral pathology. Philadelphia, J. B. Lippincott Co., 1956, p. 92.

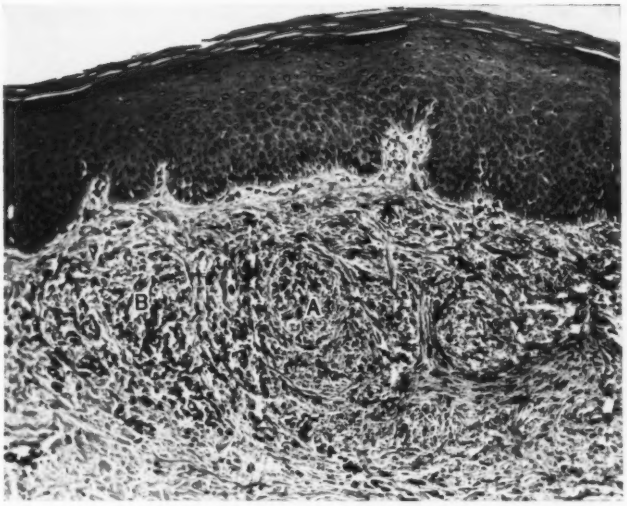

Fig. 1—Case 1. Loosely arranged, spindle-shaped blue nevus cells laden with pigment lying within lamina propria and separated from epithelium by narrow zone of normal connective tissue. Note tendency toward fasciculation at A, and large, heavily pigmented chromatophores at B. (Hematoxylin and eosin stain)

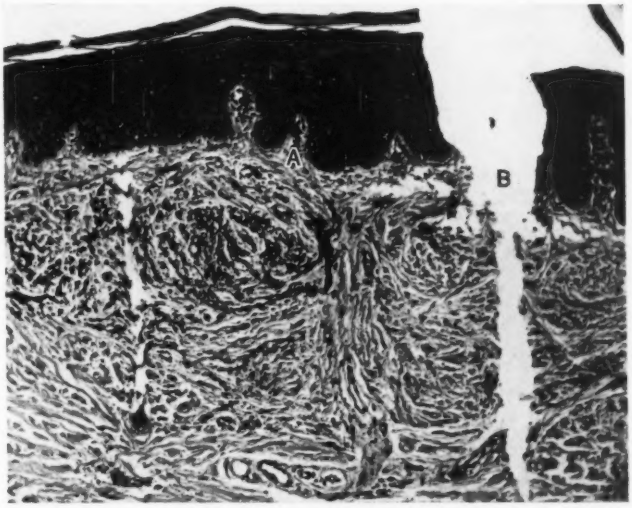

Fig. 2—Case 1. Melanin pigment stained black with silver nitrate and counterstained with hematoxylin. A, pigmented cells in dermal papilla. B, vertical slit is artifact representing initial incision made at time of excision

Turnbull's blue was negative for hemosiderin; the pigment darkened with silver nitrate, and bleached with hydrobromic acid.

CASE 2—The specimen was submitted to the oral pathology division, U. S. Naval Dental School, by Lt. Cmdr. R. A. Howard, Dental Corps, U. S. Navy. The patient was a 41 year old white woman who had a slightly elevated, sharply circumscribed, nontender, hard, bluish mass, 0.2 by 0.4 cm. in size, in the center of the left side of the hard palate. Two weeks before biopsy she had been examined by her dentist and advised that she had a pigmented lesion on her palate which should be removed. The oral surgeon's impression was that the lesion represented a blue nevus.

Grossly, the specimen consisted of a Formalin-fixed wedge of mucous membrane measuring 1.0 by 0.4 by 0.4 cm. In the center of the mucosal surface there was a sharply circumscribed, bluish black, oval area measuring 0.5 by 0.2 cm. On the cut surface a narrow, brownish-black zone was noted immediately beneath the epidermis.

Histologic examination revealed a section of mucous membrane and submucosa covered by stratified squamous epithelium. The epithelium was normal in appearance with no evidence of pigmentation or junctional activity. In approximately the lower third of the lamina propria, there were a few small, irregular groups of spindle-shaped cells with oval or cigar-shaped nuclei (Fig. 3). These cell groups were separated from the epithelium by narrow interlacing bundles of dense fibrous connective tissue. Many of the cells were filled with finely granular, dark brown pigment evenly distributed throughout the cytoplasm. A few larger, pigment-laden cells in which the granules tended to be coarser and irregular in size also were noted.

The same special staining methods were employed as described in Case 1 and the results were similar: The Lillie stain was positive for melanin; the Turnbull's blue was negative for hemosiderin; the pigment darkened with silver nitrate, and bleached with hydrobromic acid. In sections stained with silver nitrate, however, there was a notable increase in the amount of visible pigment, which extended close to the basal layer of the epithelium (Fig. 4).

■ *Summary*

The blue nevus appears as a smooth, firm, slightly elevated, blue or bluish-black papule, and occurs most frequently about the face and on the dorsa of the extremities. Most blue nevi are present at birth or appear in early infancy and persist unchanged throughout life. It is generally agreed that the blue nevus cell is a true dermal melanoblast, but the origin of this cell remains a matter of dispute.

Histologically, the typical blue nevus is composed of spindle-shaped melanoblasts filled with finely granular, dark brown melanin and arranged in small, irregular bundles in the middle and lower third of the dermis. Within and beside the cell bundles are varying numbers of chromatophores. The overlying epidermis usually shows no increased pigmentation and is separated from the blue nevus cells by a zone of normal connective tissue.

A benign cellular variant of the blue

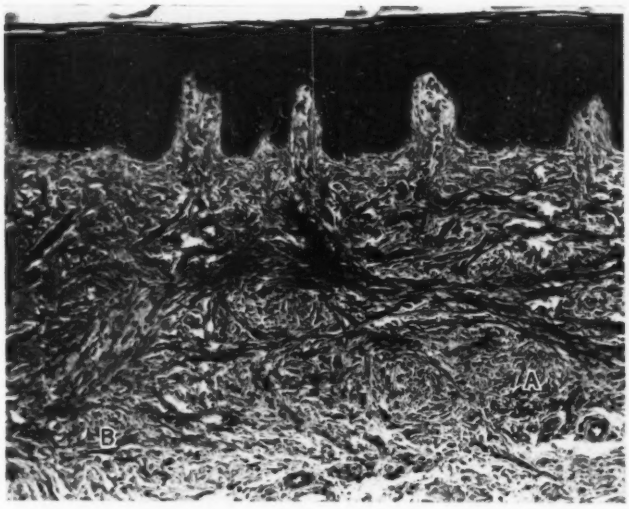

Fig. 3—Case 2. Relatively small amount of pigmentation revealed by hematoxylin and eosin stain. A, group of pigmented cells. B, a few isolated pigmented cells at B. Compare with Figure 4

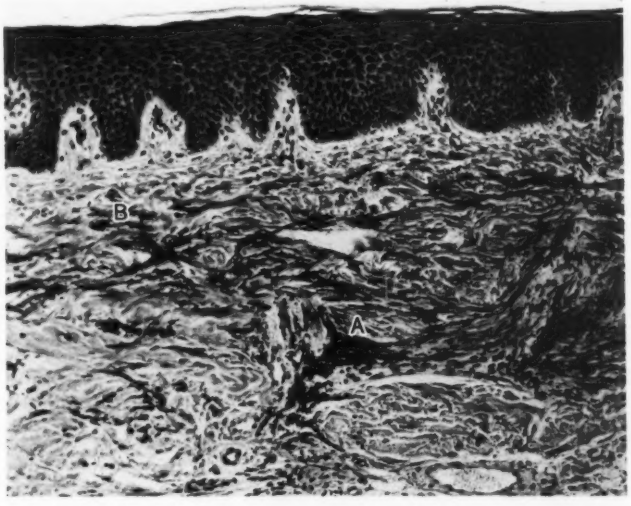

Fig. 4—Case 2. Notable increase in amount of pigmentation revealed by staining with silver nitrate and counterstaining with hematoxylin. A, clumped mass of long, bipolar blue nevus cells outlined by melanin. Cell groups lie in matrix of relatively dense fibrous connective tissue. B, scattered chromatophores

nevus, which occasionally metastasizes to a lymph node, has been described. In all the reported cases of cellular blue nevi, the patients were living and well without evidence of recurrence or metastasis for periods up to 14 years after local excision of the lesions.

Occasionally, blue nevus cells and ordinary pigmented nevus cells are intermingled in the same lesion, or a blue nevus is associated with an overlying junctional nevus. No definite transition from one cell type to the other has been demonstrated.

Malignant change in a blue nevus is extremely rare. A malignant blue nevus is a much less virulent lesion than a malignant melanoma and tends to run a protracted clinical course. In addition to the standard histologic characteristics of malignancy, necrosis is a prominent finding, and a diagnostically important feature of a malignant blue nevus. Also the malignant cells tend to become swollen and assume an epithelial or carcinomatous appearance.

The blue nevus must be differentiated from certain other blue pigmented lesions, especially from a malignant melanoma. Wide excision biopsy of a pigmented lesion which exhibits any change in color or size or both is mandatory.

Two cases of intraoral blue nevi have been described. This is the first published report of the occurrence of the blue nevus in this location.

Management of oral surgical problems complicated by maxillary sinus involvement

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Since the maxillary sinus is intimately associated with maxillary dental structures, complications frequently arise which involve the sinus. The successful management of these complications is dependent on a good working knowledge of the anatomy, pathology and physiology of the region. Case reports illustrating the complication of infection, displaced roots, fractures, cysts and tumors involving the antrum and the principles of successful management are described in detail.

The anatomic proximity of the maxillary sinus to the dental structures of the maxilla commonly is responsible for complications which require special consider-

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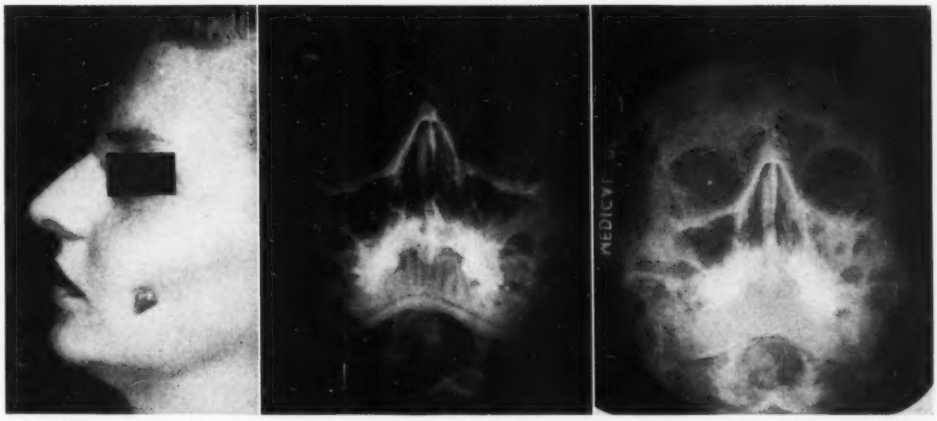

Fig. 1—Case 1. Left: Preoperative view of patient. View at time of first visit (center) and one year later (right). Note difference in extent of antral involvement

ation. For example, lesions originating in the maxillary alveolus may involve the sinus by extension, invasion, displacement, or perforation – thereby causing dual involvement and presenting problems in diagnosis and treatment. The purpose of this paper is to report several cases which demonstrate some oral surgical problems complicated by maxillary sinus involvement and the manner in which they were managed successfully. Those to be discussed include: (1) infections; (2) displaced roots; (3) fractures; (4) cysts, and (5) tumorous anomalies.

■ *Infections*

Periapical infections of maxillary bicuspids and molars might reasonably be expected to seek the path of least resistance for drainage. Perforation of the antral mucosa, however, seldom occurs. More frequently the thin buccal cortex is eroded and a parulis forms on the alveolar mucosa. A very unusual case is reported in which a periapical infection arising from a maxillary first molar not only involved the sinus and produced antral polyposis, but also formed an antrodentofacial fistula.

CASE 1—The patient was a 26 year old pregnant white woman who, six years previously, had consulted a plastic surgeon for the removal of what was presumed to be a sebaceous cyst of the cheek. After the removal of this lesion, the wound had broken down and drained. She had repeatedly sought further assistance and, on two occasions, the lesion had been re-excised. Each time, the excision had been followed by recurrence.

When first seen by the plastic surgery service of the hospital, the lesion consisted of a large violescent granuloma of the cheek, firmly fixed to the underlying tissues, which produced a noticeable dimpling (Fig. 1, left). Examination revealed a dense, cordlike structure attaching the cheek to the maxilla. She was referred to the dental clinic in the belief

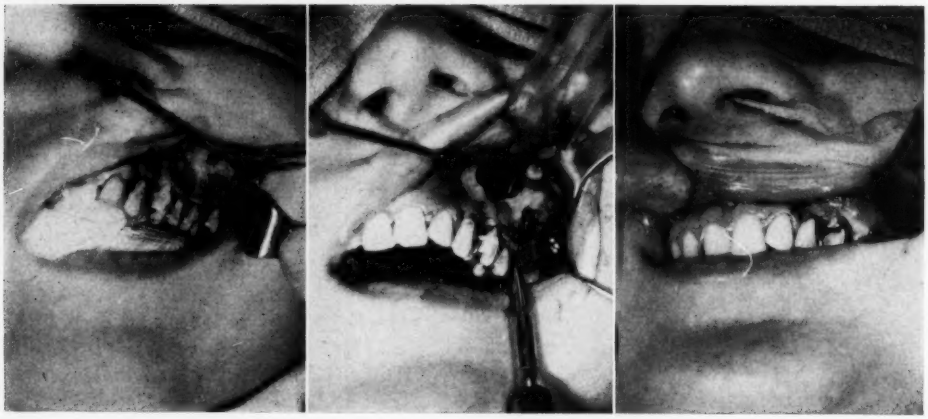

Fig. 2—Case 1. Left: Fibrous tract sectioned and freed from cheek. Center: Opening through which antrum was cleaned out. Note connection between lingual alveolus and antrum. Right: Closed incision and antral pack led out through nose

that some underlying oral pathologic condition existed.

Dental roentgenograms disclosed a small apical radiolucency involving the maxillary first molar. A Waters' view demonstrated a domelike radiopacity occupying the floor of the maxillary sinus (Fig. 1, center). The problem was diagnosed as an antrodentofacial fistula arising from an infected maxillary first molar.

Because of the patient's reluctance to submit to an operation during her pregnancy, treatment was deferred until a convenient time after parturition. Then it was noted that there was a considerable increase in density throughout the sinus (Fig. 1, right). No other changes of note had occurred except a severe postnasal drip and a feeling of stuffiness which accompanied the increased antral filling.

A second division block anesthesia was obtained with a 2 per cent lidocaine hydrochloride and 1:50,000 epinephrine solution, and an incision was made opposite the cuspid and carried into the mucobuccal fold. The attached gingiva was elevated, exposing the entire lateral maxillary wall. The fistula was dissected out and sectioned at the level of the deep fascia of the face (Fig. 2, left). The maxillary first molar was removed and the apical abscess curetted. At this time, it was noted that the buccal alveolus, which was attached to the fistula, did not connect with the lingual alveolus or with the sinus. An instrument inserted into the lingual alveolus passed freely into the sinus with the liberation of small amounts of extremely foul-smelling pus.

The sinus was entered through the canine fossa. Large quantities of antral polyps were found bathed in a foul-smelling, thin exudate, and were removed by curettage (Fig. 2, center). After the sinus had been cleaned thoroughly, communication was established between the nose and the sinus through the anterior medial wall of the sinus, emerging beneath the

inferior turbinate of the nose. This opening was enlarged with back-biting rongeur forceps. The sinus was packed with carefully layered sterile petroleum jelly iodoform gauze which was led out of the nasal opening (Fig. 2, right). The oral wound was closed. Immediately after the operation it was noted that the dimpling of the cheek was greatly improved.

No postoperative difficulties were encountered, and after seven days the antral pack was removed. The patient was returned to the plastic surgery service with the recommendation that the facial defect could now be repaired with some hope of cosmetic success.

Fig. 3—Case 2. Palatal root of maxillary third molar in maxillary sinus. Obviously, attempts to remove root through alveolus would likely be unsuccessful

DISCUSSION—This case illustrates the unusual avenues along which a simple periapical infection may spread and the severe problems which can result from failure to investigate these possibilities. Doubtless, in this case all these problems could have been prevented by enlisting the assistance of a dentist prior to the treatment of the first complaint.

■ *Displaced Roots*

Reports are heard of misadventures in exodontia in which parts of teeth or even whole teeth are displaced into the sinus. The more common instance is one, such as the case to be discussed, in which a root tip lying adjacent to the sinus is fractured as the tooth is luxated and with only slight manipulation is moved from the alveolus into the antrum.

CASE 2—A 38 year old white naval officer was referred to the oral surgery division from another local dental clinic for the removal of a root from the maxillary sinus. The root had been fractured during removal of the embedded right maxillary third molar. It was conical in shape and had been displaced into the sinus with the first effort to extract it from the alveolus. The operator had described the mishap by telephone and transferred the patient to this clinic immediately.

On arrival, the patient was premedicated to relieve his anxiety, and additional roentgenograms were obtained to locate the tooth fragment. It could be seen in the sinus adjacent to the vacant alveolus (Fig. 3).

A second division block anesthesia was obtained with a 2 per cent lidocaine hydrochloride and 1:50,000 epinephrine solution, and the sinus was entered through the canine fossa. The opening in the lateral wall of the sinus was enlarged to about 1.5 cm. in diameter. The antral mucosa was displaced medially and superiorly until it was certain that the root did not lie between this membrane and

the bony wall of the sinus. Then the antral lining was incised to allow direct vision and instrumentation for easy removal of the root. The root was quickly located and lifted from within the antrum with a curved suction tip. The sinus was clear of infection or other pathosis, and it was decided that no packing or drain was needed. The oral mucosa at the tooth extraction site and over the surgical area was carefully sutured to seal the sinus.

The patient was instructed to refrain from nose blowing for at least ten days. Penicillin V was administered orally for ten days. At the end of that period, all sutures were removed and tests were made to determine the integrity of the sinus. It proved to be clear to transillumination, no air escaped when the patient produced pressure against occluded nostrils, and no symptoms of infection were apparent. The patient has had no further complaints in relation to this surgery.

DISCUSSION — This case illustrates four points which should be remembered when confronted with a tooth fragment (or other foreign body) which has been displaced into the maxillary sinus:

1. The opening through the alveolus should not be enlarged in a vain attempt at root removal. This effort only results in an excessively large opening, does not provide adequate access or vision, and complicates good closure. This method frequently will result in an oroantral fistula which may be very difficult to eliminate.

2. The antral mucosa should not be penetrated until it is certain that the foreign body has passed through. Frequently it will be found to lie between the mucosa and the wall of the bony sinus. In that event the continuity of the lining membrane can be preserved, and healing without complication is practically ensured.

3. Careful attention should be directed toward the prevention or treatment of infection. Otherwise, a fistula may develop.

4. The oral mucosa over the tooth socket should be approximated as though closing after excision of a fistula. This is the most favorable time to avoid trouble, and closure should be good even though removal of alveolar bone may be necessary.

■ *Fractures*

Fractures of the maxilla seldom fail to disrupt the integrity of the maxillary sinus. Blood hemorrhaging from rents in the mucosal wall will clot, and the characteristic clouding of the roentgenogram may be one of the most dependable indications of a maxillary or zygomatic fracture. The blood clot in a previously healthy sinus will be resorbed quickly once the fracture is reduced and immobilized, but if the sinus was diseased before the fracture occurred, the pathologic condition may complicate the healing process. Often when it is exposed surgically as a part of the planned treatment, the maxillary sinus is found to be infected or filled with polyps, and it becomes necessary to treat this condition also. Just such a situation was encountered in the management of a depressed fracture of the zygoma.

CASE 3—A 20 year old white marine with a depressed fracture of the right zygoma was transferred to this hospital

from a nearby civilian hospital where he had received emergency treatment, including suturing of facial lacerations resulting from an automobile accident.

Clinical examination revealed multiple contusions, abrasions and sutured lacerations of the face, subconjunctival hemorrhage in the right eye, and edema and ecchymosis of the right side of the face. The patient was unable to occlude his teeth. Roentgenograms disclosed a fracture of the right zygomatic arch. The lateral wall of the right sinus was comminuted through the inferior border of the right orbit, and the zygomaticofrontal suture was separated. The whole fragment of bone was rotated medially, producing a depression of the zygomatic body and arch. The right sinus was opaque (Fig. 4, left).

A second division block anesthesia was obtained with a 2 per cent lidocaine hydrochloride and 1:50,000 epinephrine solution, and the sinus was entered through the canine fossa. The sinus was found to be filled with polyps, and these were removed with a curet. The zygoma was elevated and a Guedel cuff was inflated in the sinus to maintain the elevation. The tube attached to the cuff was led out through the incision before closure. A combination of penicillin and streptomycin medication was instituted and continued until the cuff was removed.

Reduction of the fracture was not entirely satisfactory. Therefore, the next day, while the patient was under general anesthesia, an open reduction was performed at the zygomaticofrontal suture line. Additional elevation of the arch was obtained with a tenaculum, and immobilization at the suture line was secured with a transosseous stainless steel wire.

Healing was uneventful. The skin sutures were removed on the fifth postoperative day, and the Guedel cuff was removed and the mucosa closed on the tenth postoperative day.

DISCUSSION—This case is particularly interesting because it demonstrates an unexpected complication which was disclosed in the routine management of a facial fracture involving the maxillary sinus. Preoperative roentgenograms had

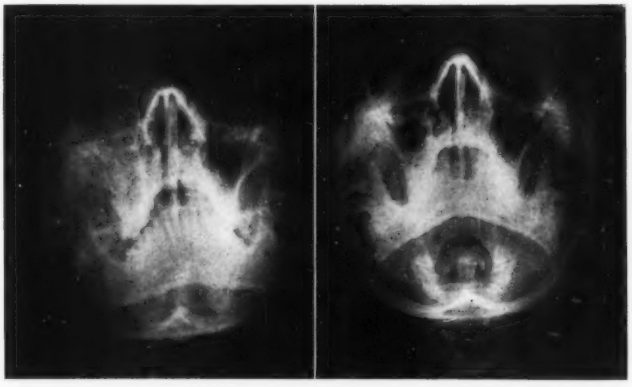

Fig. 4—Case 3. Left: View showing extensive fractures of zygomatic complex, which were thought to be cause of antral radiopacity. Right: View at time of patient's discharge

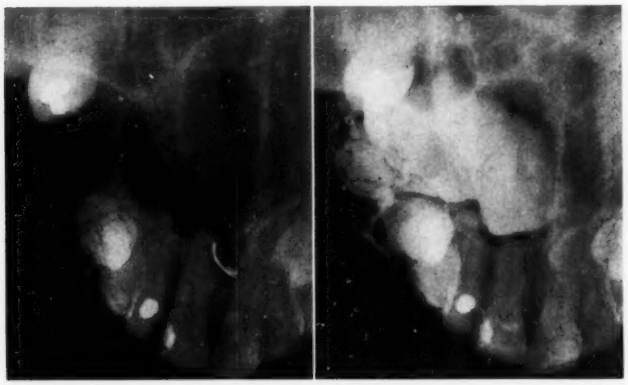

Fig. 5—Case 4. Preoperative view without (left) and with (right) contrast medium to demonstrate extent of lesion

revealed a clouded sinus on the side of the fracture, but this is a universal finding and was misinterpreted as clotted blood filling the space.

A pre-existing asymptomatic pathologic condition may be encountered during any operation, and the surgeon should be prepared to modify or extend the surgical procedure to treat both conditions adequately. In this instance, the therapy resulted in good reduction and immobilization of the fracture and also eliminated the antral pathosis. The last examination of the patient failed to disclose any recurrence of the polyps or further sinus pathosis (Fig. 4, right).

■ *Cysts*

The complex fusion of embryologic processes and the presence of tooth-forming elements in the maxilla both predispose the maxilla to the formation of cysts. Strangely, such cysts often will enlarge to massive proportions before any symptoms are noted by the patient. Teeth in the path of growth are forced aside, and the sinus membrane may be displaced completely. The size of the cyst and the extent of involvement of adjacent structures usually determine the mode of treatment.

CASE 4—A 27 year old white man was admitted to the hospital for treatment of a large cyst of the left maxilla. During a routine dental examination at another clinic, a radiolucent area associated with a retained root fragment had been observed in periapical roentgenograms. An operation to enucleate what was thought to be a radicular cyst had been attempted, but the lesion had been found to be much larger than expected. The mucoperiosteal flap had been closed without removal of the lesion, and the patient was transferred to the hospital.

A physical examination on admission failed to disclose any abnormality except the maxillary defect. Routine periapical and extraoral roentgenograms did not delineate accurately the boundaries of the clinically noted cyst (Fig. 5, left). But when the cystic fluid was aspirated and replaced by a contrast medium, additional roentgenograms clearly demonstrated the extent of the lesion (Fig. 5, right). It had

displaced but not perforated the antral membrane, surrounded the apexes of the left maxillary second molar, first bicuspid, cuspid, and lateral and central incisors (the first molar and the second bicuspid were missing), eroded the buccal alveolar plate in the bicuspid region, and extended medially to cross the midline. None of the roentgenograms (periapical, occlusal, or extraoral) showed the residual root described before admission. It was assumed that it had been removed during the earlier exploratory procedure.

The fluid aspirated prior to the contrast medium studies was submitted for bacteriologic study, and was found to contain streptococci and staphylococci. Therefore, proper antibiotic therapy was begun.

An evaluation of all findings led to the conclusion that an attempt to excise the cyst would risk the loss of teeth and violation of the sinus, and result in a maxillary deformity which would present a prosthetic problem. A conservative alternative, exteriorization, was considered the best method for managing this particular lesion.

Infiltration anesthesia was accomplished with a 2 per cent lidocaine hydrochloride and 1:50,000 epinephrine solution, and a semicircular incision was made over the eroded alveolar cortex. By careful dissection, the mucoperiosteal flap was detached from the cyst membrane. Part of the exposed lateral wall of the cyst was excised (Fig. 6, left) and submitted for histologic study to confirm the clinical diagnosis. A serosanguineous fluid was aspirated from the defect. Interrupted sutures were then used to approximate the oral mucous membrane to the margins of the cyst membrane wherever possible (Fig. 6, center). The cyst cavity then was packed with petroleum jelly gauze so as to maintain the surgical opening (Fig. 6, right).

Postoperatively, there was only slight discomfort, and the only disturbing feature was the hollow, drumlike sound of the voice when the surgical opening was not occluded. Repeated packing of the cystic defect with petroleum jelly gauze prevented that phenomenon and served to maintain the diameter of the opening until an obturator could be made.

Fig. 6—Case 4. Left: Cyst membrane exposed and a part of its lateral wall removed for histologic study. Fringe was left to facilitate suturing membrane to oral mucosa. Center: Oral mucosa sutured to cyst membrane wherever possible. Right: Petroleum jelly gauze pack inserted to maintain surgical opening

It was planned to fabricate a maxillary partial denture which would serve not only to replace missing teeth but also, by means of an extension on its flange, to maintain the surgical opening. Before the prosthetic device could be made, however, it was necessary to rehabilitate the natural dentition. The maxillary right first bicuspid and third molar were extracted and several restorations were placed. Endodontic therapy was started on the pulpless maxillary left lateral incisor, which may have been the original etiologic factor in the cyst formation, since the residual root, previously alleged to be in the bicuspid region, was never found.

The maxillary partial denture, including the obturator, was completed, and its insertion ended the necessity of regularly changing the dressings (Fig. 7). The defect required only daily irrigations by the patient. The patient was discharged after being impressed with the need for meticulous oral hygiene. He was instructed to return every four months for adjustments of the obturator and roentgenographic follow-up.

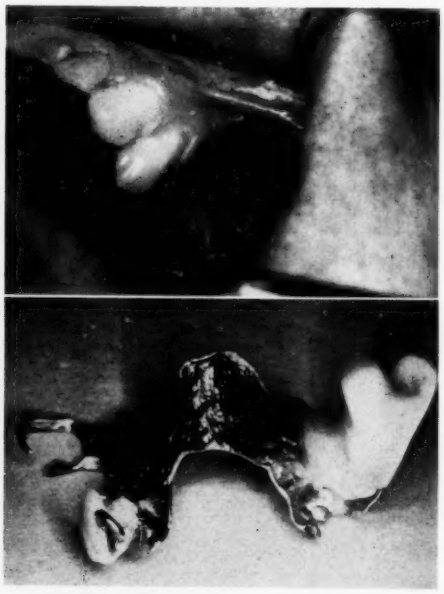

Fig. 7—Case 4. Above: Obturated opening at time of patient's discharge. Below: Partial denture with obturator attached. Size of obturator was reduced as size of defect decreased

Fig. 8—Case 4. Postoperative view 20 months later. Defect is almost completely filled in with normal appearing bone

During the following 20 months the cyst cavity gradually diminished in size and gave the patient no discomfort (Fig. 8). On two visits the obturator required minor adjustments, but the mucosa within the defect remained healthy and resembled normal oral mucosa. No teeth were lost as a result of this treatment. There appeared to be no indication for further surgical intervention during this period.

CASE 5—A 44 year old naval officer experienced a sudden onset of swelling and pain high on the right side of the face. His dentist corrected the occlusion on that side and prescribed a poultice to

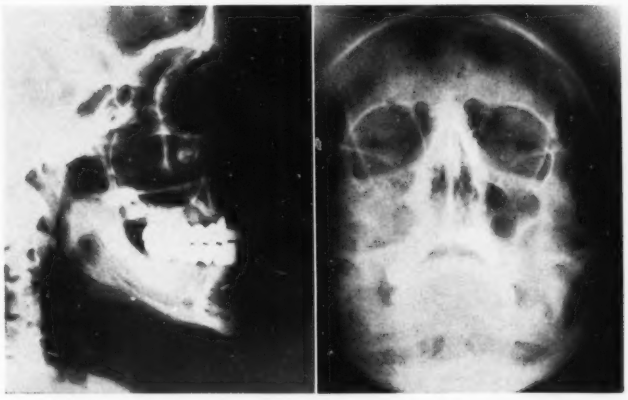

Fig. 9—Case 5. Left: View showing presence of tooth high within antrum. Right: Waters' view offers additional evidence of radiopacity of sinus and locates tooth mediolaterally

be applied over the region of the tuberosity intraorally. One day after this treatment, the patient discovered that a white, viscid, odorless fluid had drained during the night. There was complete remission of pain and swelling. To maintain drainage, his dentist introduced an iodoform gauze wick on the buccal aspect of the alveolar process immediately distal to the second molar. The patient, who was then comfortable, was referred to us for consultation and treatment.

The results of the general physical examination were all within normal limits. An oral clinical examination revealed a very neatly restored dentition with intact healthy mucosa except on the buccal aspect of the alveolar process in the region of the right tuberosity, where a draining fistula was apparent. An oral and facial roentgenographic survey revealed a generalized clouding of the right maxillary sinus and the presence of a well-developed tooth within the anterosuperomedial part of the sinus. There was evidence of erosion or demineralization of parts of the floor and outer wall of the sinus, and there were two small radiopaque bodies, assumed to be dental cement, distal to the roots of the second molar (Fig. 9).

Since aspiration and contrast medium studies suggested the presence of a solid tumor, a biopsy was performed. An incision was made over the tuberosity to reflect a mucoperiosteal flap and expose the wall of the lesion. In this region the mucous membrane and the periphery of the lesion were in proximity, and separating the two at this point was not possible. Retracting the flap immediately exposed a large cystlike space which was filled with whitish-yellow curdlike material. This was curetted in great quantity from the cavity and was submitted with a specimen of the wall of the space for histologic study. The foreign bodies distal to the second molar were removed and proved to be dental cement. The flap was replaced and approximated with interrupted sutures.

Roentgenograms taken ten years previously for other reasons were sent for, and they confirmed the presence of the tooth—at that time in the middle of the sinus.

The pathology report confirmed the

diagnosis of a cyst. The strands of curd-like material were layers of keratin.

The patient was premedicated with 100 mg. of pentobarbital sodium, and, with the patient under second division block and infiltration anesthesia (obtained with a 2 per cent lidocaine hydrochloride and 1:50,000 epinephrine solution), a cystectomy was performed. An incision was made intraorally through the previous incision in the tuberosity, carried anteriorly along the necks of the teeth to the right lateral incisor, and then extended vertically into the labial sulcus. The outlined mucoperiosteal flap was reflected to expose the entire lateral wall of the maxilla. An opening was then made through the bone above the bicuspids (Fig. 10, above). Through this opening and through the eroded wall in the tuberosity region it was then possible to detach the cyst and included tooth from the sinus and remove the entire lesion en masse (Fig. 10, below). The flap was replaced and carefully secured with interrupted sutures.

Fig. 10—Case 5. Above: Bridge of bone between anterior and posterior openings was left to aid in supporting zygoma. Below: Contents of cyst. Note tooth to left

The patient was treated with intramuscular injections of 300,000 units of procaine penicillin and 0.5 Gm. of streptomycin twice daily for one week. At the end of that time, the soft tissues were healed, but it was noted that communication between the sinus and the mouth persisted in the region of the earlier fistula. It was decided to deal with this problem at a later admission; therefore, all medication was discontinued, the sutures were removed, and the patient was discharged from in-patient treatment.

One month later the patient was readmitted for closure of the oroantral fistula. With the patient under local anesthesia, a full-thickness buccal flap was raised and transposed to cover the defect. The epithelial tract was excised, the surrounding surface freshened, and the flap sutured in place. A previously constructed acrylic splint was wired to the maxillary teeth to stabilize the flap.

Intramuscular antibiotic therapy with 300,000 units of penicillin every 24 hours was begun, and the patient was seen daily. On the third postoperative day some edema was apparent in the right cheek, and on the sixth day some suppuration was noted at the posterior border of the

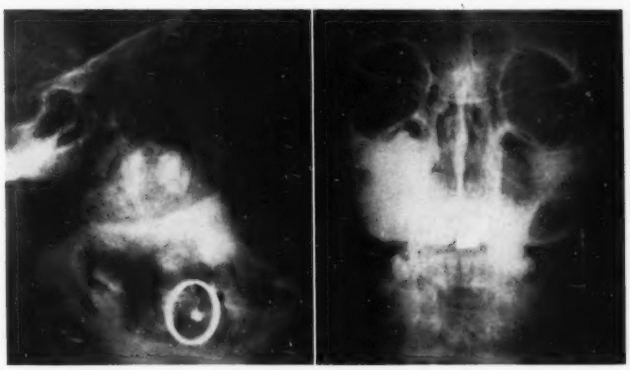

Fig. 11—Case 6. Large dense structure appears to fill all but apex of antrum and to contain some reasonably well-formed teeth

splint. On the ninth day the splint was removed, and it was observed that the flap covering the oroantral opening was only partially attached and that some leakage occurred at the posterior border. Medication was discontinued and the patient discharged with only partial closure of the defect, to be readmitted at a later date for completion of the closure.

One month later a third operation was performed to close the oroantral defect. The method described, including the use of antibiotics and an acrylic splint, was employed. This effort was successful and no further treatment was required.

Periodic postoperative follow-up has been possible for two years and there have been no complicating sequelae. The involved sinus appears to be in good functional health.

DISCUSSION—These two cases (4 and 5) illustrate instances in which an odontogenic cyst extended into the sinus. The presence of a tooth in one instance (Case 5) necessitated surgical removal, and this resulted in loss of integrity of the antral membrane and an oroantral fistula which required subsequent repair. In the other (Case 4), simple exteriorization preserved the integrity of the antral membrane and permitted re-establishment of normal structure and function without surgical intervention. In neither instance was the antral membrane invaded. It never is by a cyst. Destruction of the membrane in Case 5 was a surgical necessity, not a result of cystic invasion.

■ *Tumorous Anomalies*

The tooth-forming elements in the maxilla occasionally give rise to solid tumorous anomalies which, like cysts, may encroach on the maxillary sinus.

CASE 6—The patient was first seen for a routine dental examination prior to the fabrication of a partial denture. At that time, the maxillary right first molar was condemned and an effort was made to extract it. This resulted in fracture of the roots without any noticeable luxation. Roentgenograms then were taken, and they revealed an enormous radiopaque area involving the right maxilla. The patient was referred to us for treatment. Additional roentgenograms were taken and they revealed the shape and extent of

Fig. 12—Case 6. Impacted bicuspid was blocked by but not attached to lesion and was left in hope of its eventual eruption

the lesion, which appeared to obliterate almost the entire maxillary sinus (Fig. 11).

Under nasoendotracheal gas, oxygen and thiopental sodium anesthesia, an incision was made, exposing the buccal and alveolar portions of the dense mass. The thin bone covering was removed. With a large fissure bur, the mass was cut up into many pieces and fractured with instruments. After most of the mass had been removed in this way, it was possible to enucleate the small remaining superior part in one piece. No direct communication with the nose was seen after the removal of the mass. A quantity of reddish tissue was noted at the apex of the defect, and it was assumed that this was the residue of the antral membrane which had been displaced by the growth of the anomaly. The mucosal flap was closed and a previously constructed splint was wired in place to support it.

The patient's postoperative course was uneventful, and when discharged, he had a well-healed wound which did not communicate with the maxillary sinus. Roentgenographic evidence suggested that the maxillary antral membrane had re-inflated (Fig. 12).

DISCUSSION—This case illustrates two important points: First, involvement of the maxillary sinus by discretely circumscribed lesions does not necessarily mean that the antral mucosa is perforated or invaded. Frequently, the pathologic condition can be removed without serious damage to the antral lining, which can then re-establish its normal integrity. Second, the use of splints to support mucosal flaps may serve to prevent breakdown of the incision and liquefaction and loss of the hematoma when large defects are involved.

■ *Summary and Comment*

A series of cases has been reported to exemplify lesions of the maxilla which may involve the maxillary sinus. The treatment in each case was intended to eradicate the pathosis with the least injury to all adjacent structures. It is universally agreed that maintenance of healthy air sinuses is desirable, and that in treating pathoses of the head, all efforts should be exerted to preserve the air sinuses, or, when they are involved, to return them to a condition of good health. In each of the cases discussed, this principle influenced our choice of therapy. The methods that were used are all based on sound surgical principles and are accepted procedures. They are discussed in this report solely for the purpose of demonstrating when and how they may be useful.

Treatment of zygomatic fracture-dislocations

■ *Walter W. Crowe, D.D.S., U. S. Navy*

Open visual reduction of fractures of the zygoma with direct wiring of the fragments at the zygomaticofrontal suture line has many advantages over other methods of reduction since it allows direct inspection of the fracture lines to assure proper alignment of the fragments. Preoperative study must include good quality roentgenograms and intraoral as well as extraoral examination. Care should be taken to make certain that jaw function is not impaired by impingement of the zygoma on the coronoid process.

Facial trauma in the military service as well as in civilian life appears to be increasing continuously. This increase is due primarily to the modern high speed method of transportation, with its ever increasing hazards. Injuries of this type are usually of a far more serious nature than those suffered by the average athlete or individual engaging in pugilistic encounters.

The zygoma, because of its anatomic position, is liable to fracture-dislocations, with displacement in the direction of force. This bone forms a very important part of the facial framework, and serves as a buttress between the face and the skull. It assumes a most important role in protecting the eye, and participates in the formation of the orbital cavity, the maxillary sinus, the temporal fossae, and the zygomatic arch. Traumatic injuries of the face rarely involve the zygoma alone, but tend to involve the articulating surfaces, which are the maxilla, temporal, frontal, and sphenoid bones. Injuries of this nature are referred to as fracture-dislocations of the zygomatic compound. In fracture-dislocations, the zygoma may be separated in combination at the zygomaticofrontal, zygomaticotemporal, zygomaticomaxillary, and zygomaticosphenoid suture lines.

After facial trauma there is usually considerable edema and ecchymosis with a "black eye" which often mask the true nature of the injury. Failure to recognize these fractures and their displacement may result in permanent facial deformity and other associated complications. Separations at the zygomaticofrontal suture line displaces the lateral palpebral ligament and outer canthus of the eye in a downward direction. This results in alteration of the eyeball level with abnormal muscular function and diplopia. Enophthalmos may occur should the orbital floor be crushed and displaced inferiorily with orbital enlargement, and subsequent absorption of the orbital fat due to trophic disturbances.

Exophthalmos is not uncommon in compound comminuted fractures because

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of intraorbital hemorrhage. Bleeding in the anterior chamber of the eye may result in temporary or permanent blindness. Palsy of the extraocular muscles may result from intraorbital hemorrhage or injury to the orbital attachment of the muscle. Severe concussion may result in retinal detachment. Complications associated with medial orbital fractures are lacerations of the medial palpebral ligament, injuries to the tear sac, and fracture of the lacrimal, nasal and ethmoid bones.

In order to establish the visual acuity and ocular motility of the eye, a careful examination by an ophthalmologist is of extreme importance. The functional integrity of the eye should be well established before attempting any form of definitive treatment.

■ *Diagnosis*

The diagnosis of fractures of the zygoma requires a careful clinical and roentgenographic examination. A decided flatness of the face may become apparent when facial edema begins to disappear. By bimanual palpation of the infraorbital margins simultaneously, the classic "step off" may be noted on the affected side, along the infraorbital rim at the zygomaticomaxillary suture line. A separation also may often be noted, with point tenderness at the junction of the zygomatic and frontal bones. Injury to the infraorbital nerve is manifested by nerve anesthesia on the injured side of the face. Unilateral nasal hemorrhage, emphysema of the eyelids, and subconjunctival hemorrhage are relatively common findings.

Lack of normal condylar mobility with limitation of the oral opening may become apparent, and is due to a muscular spasm or impingement of the zygomatic arch against the coronoid process. A thorough intraoral examination by the index finger high in the buccal sulcus may reveal bony deformities and abnormalities not otherwise recognized.

Roentgenography is an invaluable aid in the diagnosis and treatment planning of fracture-dislocations of the zygoma. The roentgen views of value are: (1) submento vertex or zygomatic arch view; (2) stereoscopic Waters' and stereoscopic Caldwell views, and (3) laminagraphy may be helpful when greater detail is desired. Routine posteroanterior views of the face and lateral views of the skull have little or no value.

■ *Methods of Treatment*

Many methods of treatment have been employed for the reduction, approximation, and fixation of zygomatic fractures.[1-13] It is well to remember that in any form of severe facial trauma, the patient should always receive emergency first aid treatment at the time of injury. Subsequent evaluation for possible neurologic damage must precede the consideration of any form of extensive facial

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repair. As a general rule, if there are no complicating factors such as intracranial injury, definitive treatment of soft tissue trauma and facial fractures should be accomplished within the first 24 to 48 hours after injury, or as soon thereafter as neurosurgical clearance has been given.

Since the advent of antibiotics and chemotherapy, with the modern improved methods of patient management and anesthesia, a new method of treatment has appeared. No longer is it necessary to use cumbersome and uncomfortable intraoral and extraoral appliances in the reduction and fixation of facial fractures. Conservative methods of treatment formerly employed have been replaced to a large extent by open operations which offer not only direct access to the fracture site but permit greater stability by direct wire fixation. Conservative methods of treatment have often proved disappointing, even though from a clinical and roentgenographic standpoint, the fracture appeared to be fairly well reduced. Without adequate reduction and fixation during the healing period, the cosmetic and functional end result may be severely compromised by even minor postoperative trauma and muscular contractions.

■ *Technic of Recommended Treatment*

A procedure of open reduction with direct wire fixation in the treatment of fracture-dislocations at the zygomaticofrontal and zygomaticomaxillary suture lines will be described and illustrated. This procedure insures stability of the fragments during the healing period, and by direct vision and wire fixation, a result far superior to those obtained with conservative closed methods of reduction is practically assured.

An incision is made at the lateral end of the brow, about 1.5 cm. in length. Another incision is made, if indicated, parallel to the skin folds at the lower limit of the lower lid, which gives adequate exposure of the infraorbital rim. It is seldom, however, that this second incision is necessary, providing the zygoma has been well positioned and immobilized at the zygomaticofrontal and zygomaticotemporal suture lines. After surgical exposure of the suture line, the degree of separation can be determined readily. Soft tissues which may have become incarcerated between the suture lines are retracted in order to obtain good apposition of the bone fragments. Adequate exposure is necessary in order to prevent undue trauma. The posterior surface of the frontal process of the zygoma is exposed by retraction of the soft tissues, temporalis muscle and periosteum.

By means of a no. 4 straight round bur and handpiece, a hole is made from the anterior surface of the frontal process of the zygoma toward the temporal fossa. This original drill hole is made approximately 6 mm. inferior to the separation of the zygomaticofrontal suture line (Fig. 1). Only a slight angulation of the round

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Fig. 1—View of skull showing position of drill holes made above and below the zygomaticofrontal suture line. Superior hole has been slightly enlarged, allowing access of bur to temporal fossa

bur toward the temporal fossa is necessary, since the frontal process of the zygoma in this region overlies the anterior border of the temporal fossa and great wing of the sphenoid bone. The underlying soft tissues must be adequately retracted and protected during this procedure.

The second hole by the round bur is made in the angular process of the frontal bone, approximately 6 mm. above the zygomaticofrontal suture line. This process of bone is one of the strongest components of the face and is rarely fractured. It may be used if indicated to support the middle one third of the face in craniofacial separations (Fig. 2). The correct angulation of the round bur toward the temporal fossa at this point is very important, in order not to cut too deeply into the frontal bone (Fig. 3). Incorrect angulation of the bur will result in not gaining access to the temporal fossa. It will be found necessary to enlarge slightly the external opening in order to permit the bur shaft to penetrate deeply enough into the bone to complete the drill hole into the temporal fossa (Fig. 1).

After completion of the two drill holes, a single strand of 26 gauge stainless steel wire is passed from the anterior surface of the angular process of the frontal bone and the frontal process of the zygoma toward the temporal fossa. The two ends are picked up and twisted

Fig. 2—Postsurgical roentgenogram showing open reduction of right zygomaticofrontal suture line by direct wiring. Internal craniofacial suspension wires pass through drill hole in right frontal bone, then posterior and medial to temporal process of zygoma. Suspension wires are attached to maxillary arch bar in second bicuspid region. A suspensory wire passed around an intact left zygomatic arch completes suspension wire fixation

Fig. 3—Temporal fossa, zygomatic arch, and posterior surfaces of zygomatic and frontal bones are shown. Note position of drill holes, stainless steel wire, and tie knot

rather loosely together. It will be noted that no holes have been made into or toward the orbital cavity (Fig. 4).

The next procedure is to elevate the depressed or impacted zygomatic bone, which in most instances will be found to be depressed downward, inward, and backward. A small stab incision is made through the skin and subcutaneous tissues, parallel to and slightly below the inferior border of the zygoma, and bisected by an imaginary line extending from the lateral orbital rim. A malar hook is inserted carefully through this small incision, and pressed inward and upward until it engages the inferior border of the zygoma (Fig. 5). By upward and outward controlled hand pressure, the zygoma is slowly elevated into a normal anatomic position, which closes the separated zygomatico frontal suture line.[14] The malar hook is held firmly in contact with the inferior surface of the zygoma by the index finger and thumb of the left hand while the stainless steel wire is being tightened (Fig. 5). Controlled inward and upward finger and thumb pressure insures that the malar hook will not become displaced and traumatize the soft tissues of the face. It will be noted that the shaft of this instrument parallels the orbital rim, and lies directly over the zygomaticofrontal suture line (Fig. 5).

The wires lying on the posterior surfaces of the frontal and zygomatic bones are twisted tightly together, and the ends of the wire are cut off rather short and adapted closely to the bone. The wire

Fig. 4—Orbital view of skull showing position of stainless steel wire. Note that drill holes have not been made into the orbital cavity

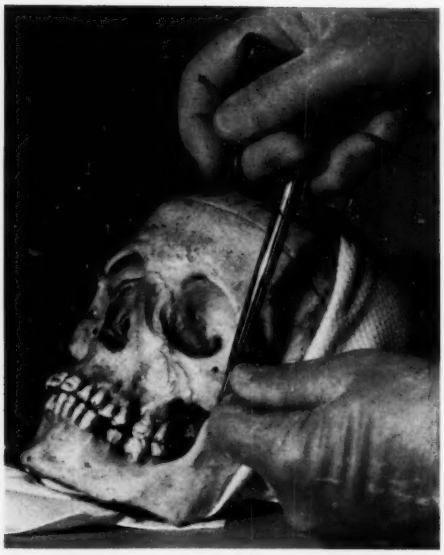

Fig. 5—Malar hook engaging inferior border of zygoma. Note position of right hand and index finger and thumb of left hand

knot is made to lie on the posterior surface of the zygoma, below the zygomaticofrontal suture line. The temporal fossa deepens considerably in this region, preventing palpation of the wire knot through the soft tissues (Fig. 3). If there is good bony apposition at the zygomaticofrontal and zygomaticotemporal suture lines, it is often unnecessary to expose the zygomaticomaxillary suture line for further reduction. Severe comminutions of the orbital floor which do not elevate with the zygoma at time of reduction are treated by packing of the maxillary sinus, with direct bone wiring when indicated, in order to support adequately the orbital floor during the healing period. A nasal antrostomy facilitates removal of the packing, which should not be removed for about 20 days, or until some healing has occurred. Removal of the antral packing at too early a date will predispose to a poor cosmetic and functional result.

A conventional form of open reduction with direct wire fixation of the zygomaticofrontal suture line is that in which holes are made by a surgical bur from the anterior surfaces of the frontal process of the zygoma and angular process of the frontal bone into the orbital cavity (Fig. 6). This surgical procedure with wire fixation does give adequate immobilization of the zygomaticofrontal suture line, but there is always the possibility of infection and displacement of the lateral palpebral ligament of the eye. Surgical trauma may also predispose to a functional ptosis of the eye. In addition, it is not desirable to have a wire knot lying on the frontal process of the zygomatic bone (Fig. 7). Postoperatively the soft tissues may become sensitive to palpation, necessitating surgical removal of the stainless steel wire.

The advantages of open reduction with direct wire fixation as illustrated in Figures 1 to 5 are summarized as follows:

1. The tissues overlying the lateral orbital rim and zygomaticofrontal suture line are not tender to palpation, and there is no underlying wire knot to irritate the soft tissues.

2. By utilization of unilateral or bilateral suspension wires as indicated, from the angular process of the frontal bone, concomitant facial injuries may be supported successfully during the healing period.

3. The location of the stainless steel wires on the posterior surfaces of the zygomatic and frontal bones is not objectionable. The wire knot cannot be

palpated since it lies fairly deep in the temporal fossa.

4. The possibility of orbital trauma, infection, or injury to the extraocular muscles of the eye during surgery is reduced to a minimum, since no drill holes have been made into or toward the orbital cavity.

5. A satisfactory cosmetic and functional result should be attained by proper anatomic positioning of zygomatic fracture-dislocations, utilizing open reduction, adequate elevation, and direct wire fixation.

■ *Report of Cases*

The following three typical cases of mild, moderate, and severe forms of zygomatic facial trauma illustrate the effectiveness of the technic of treatment described herein.

CASE 1—A 22 year old Caucasian seaman had sustained facial contusions and a laceration of the upper left lip during a fight (Fig. 8, above left). Physical examination at the time of admission on the day of injury revealed a laceration of the upper left eyelid and lip, with the loss of several teeth. There was tenderness over the junction of the left zygomatic and frontal bones. The vision was 20/20 in each eye.

Roentgenographic examination revealed a separation at the left zygomaticofrontal suture line (Fig. 8, above right), and fractures of the fourth and fifth ribs on the left.

Three days after admission, under general anesthesia, an open reduction was performed, with elevation of the left zygomatic bone by means of a malar hook

Fig. 6—Drill holes have been made into orbital cavity, with stainless steel wire fixation

Fig. 7—Position of wire knot is shown lying on frontal process of zygoma

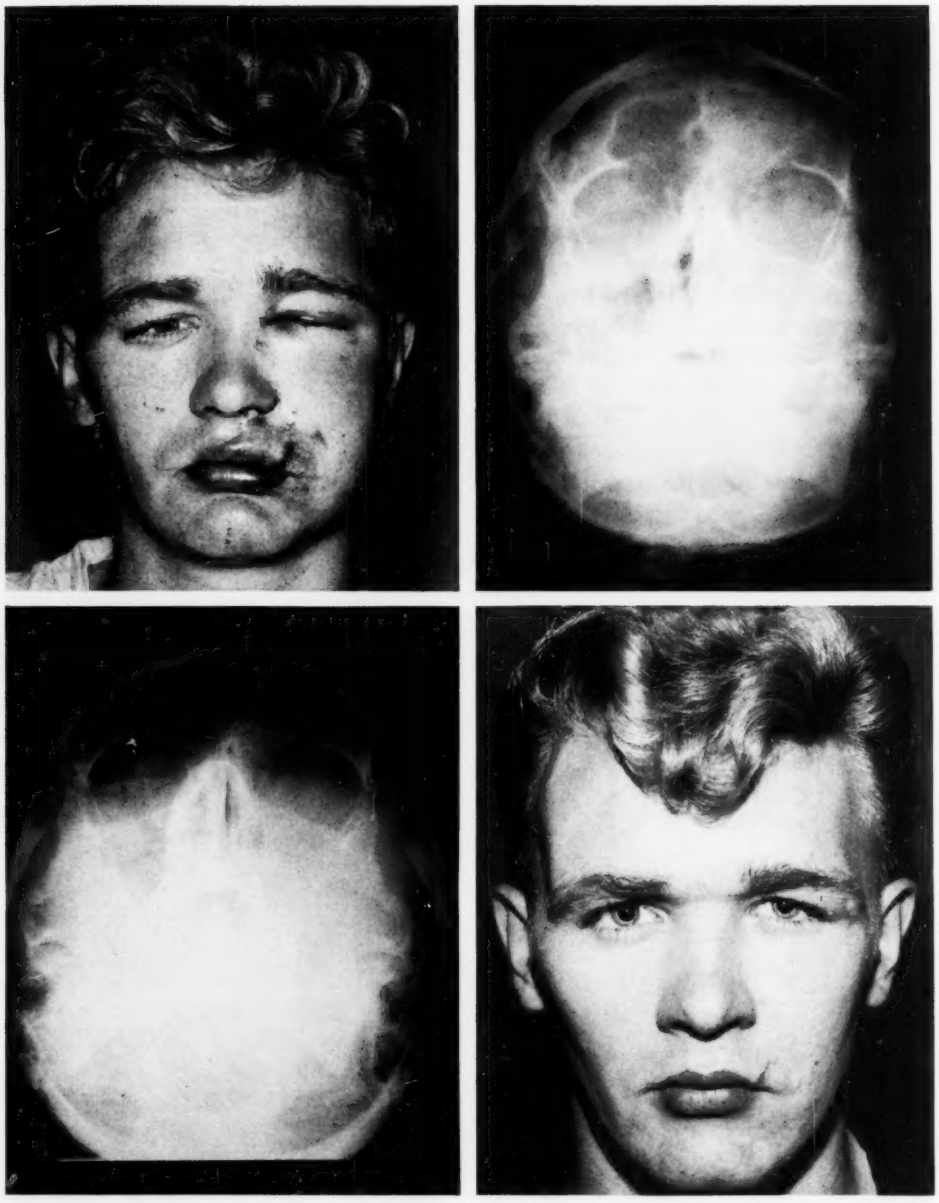

Fig. 8—Case 1. Above left: Appearance of patient at time of admission. Above right: Extent of separation at left zygomaticofrontal suture line. Below left: Postsurgical view after open reduction of left zygomaticofrontal suture line and direct wire fixation by stainless steel wire. Below right: Appearance of patient at completion of treatment

and direct wire fixation of the left zygomaticofrontal suture line by means of a single strand of 26 gauge stainless steel wire (Fig. 8, below left).

Twenty-one days after surgery, the patient was returned to a duty status with normal ocular motility and 20/20 vision in each eye. The operative incision at the lateral end of the brow was well healed (Fig. 8, below right). The condyles functioned in a normal manner, and the patient was asymptomatic.

CASE 2—A 24 year old naval aviator had crashed on the deck of an aircraft carrier during an attempted landing, and subsequently was carried over the side of the ship in his damaged plane. He was rescued immediately, and regained consciousness within a few minutes. Physical examination revealed a well-developed, well-nourished white man, in fairly good condition, who was mentally clear, with no evidence of shock. The left side of his face was considerably swollen, with periorbital edema and ecchymosis. There were also several facial lacerations. Diplopia was evident on upper gaze and in the primary position.

Roentgenographic examination revealed fractures of the nasal bones, extending through the medial wall of the orbit. There were zygomatic fracture-dislocations at the left zygomaticomaxillary and zygomaticofrontal suture lines. The left orbital floor and lateral wall of the maxillary sinus were depressed inferiorly, which resulted in dislocation of the left zygoma and maxilla. There was fluid and air in the right maxillary sinus, with complete opacification of the left maxillary sinus (Fig. 9, above left).

On the second day after the patient was admitted to the hospital, an open reduction was performed under general anesthesia, with elevation of the left zygomatic bone by means of a malar hook. A single strand of 26 gauge stainless steel wire was utilized for direct wire fixation of the left zygomaticofrontal suture line (Fig. 9, above right). The left orbital rim and floor appeared to be in good anatomic position, and a Caldwell-Luc approach with sinus packing, or direct wire fixation of the left zygomaticomaxillary suture line was not considered to be indicated.

Postreduction roentgenograms revealed the orbital cavity, including the infraorbital rim and floor to be anatomically satisfactory in size and contour (Fig. 9, above right). The teeth were immobilized during the healing period by means of maxillary and mandibular arch bars with intermaxillary fixation.

Thirty days after surgery, the patient was returned to a duty status. The facial fractures had healed solidly in good position, with a normal facial contour. The teeth were in excellent occlusion, and the condylar mobility and function was normal. The patient had no diplopia in any position of gaze, and his vision was 20/20 in each eye. The operative incision at the lateral end of the brow and the facial lacerations were well healed (Fig. 9, below).

CASE 3—A 21 year old aviation bosun mate, third class, had sustained a severe crushing injury to the left zygoma, when he was accidentally hit by a hydraulic crank aboard an aircraft carrier. The facial lacerations had been sutured before transfer of the patient to the hospital. Physical

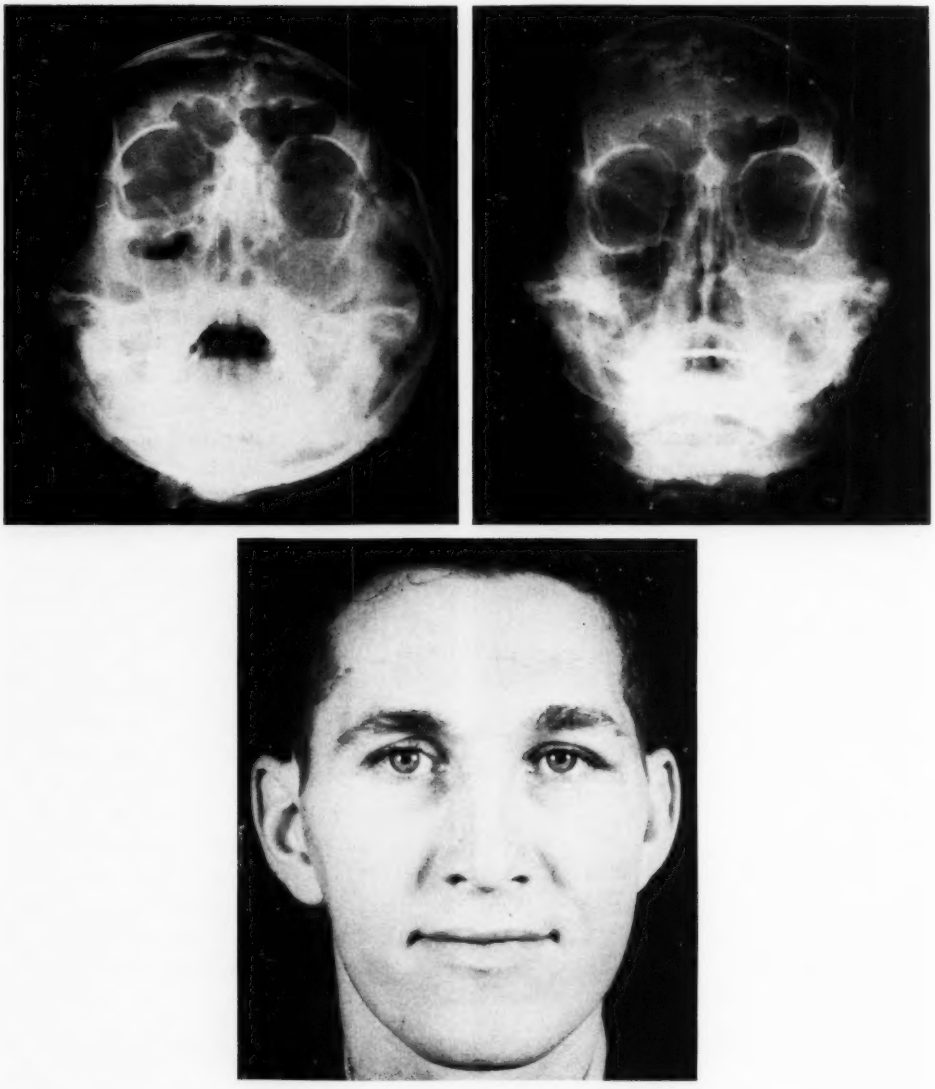

Fig. 9—Case 2. Above left: Roentgenogram showing orbital enlargement with downward displacement of the zygoma. Note separations at the zygomaticofrontal and zygomaticomaxillary suture lines. Above right: Postsurgical roentgenogram. Direct wire fixation insures continuity of zygomaticofrontal suture line. Left orbital rim and floor appear normal in position and contour. Below: Postoperative view showing minimal scar at lateral end of brow, with bilateral facial and ocular symmetry

examination at the time of admission revealed a well-developed, well-nourished white man, with considerable facial deformity. There was periorbital edema and ecchymosis about the left eye with subconjunctival hemorrhage (Fig. 10, above left). Palpation of the left orbital rim revealed the classic "step off" along the inferior rim of the orbit, with tenderness and separation at the left zygomaticofrontal suture line. There was downward displacement of the left eyeball with abnormal ocular function and diplopia. Infraorbital nerve injury was manifested by anesthesia on the injured side of the face.

Roentgenographic examination revealed a severe fracture involving the left zygoma with a separation at the left zygomaticofrontal suture line of about 1 cm. There were additional fractures through the left zygomatic arch, the floor of the orbit, the zygomaticomaxillary suture line, and the medial and lateral walls of the antrum. The zygoma was displaced posteriorly and medially into the left maxillary sinus, and the antrum was opacified by hemorrhage (Fig. 10, above right).

Three days after the patient's admission, an open reduction was performed under thiopental sodium, nitrous oxide-oxygen endotracheal anesthesia with succinylcholine chloride. The left zygoma, which had been severely impacted into the left maxillary sinus was elevated from the sinus with considerable difficulty, using a malar hook, through a Caldwell-Luc approach. Incisions were made to expose the zygomaticomaxillary and zygomaticofrontal suture lines, and holes were drilled in the bone. Utilizing single strands of 26 gauge stainless steel wire, the zygoma was held in a good anatomic position by direct wire fixation (Fig. 10, below left).

A transantral exposure was employed to permit adequate manipulation of the bony fragments of the orbital floor, in order to insure proper repositioning and support of the globe. The sinus was packed with one inch iodoform gauze, and the orbital floor was kept under direct vision through the lower lid incision during the entire procedure in order to insure maximum safety to the optic nerve. Reestablishment of a normal orbital floor for adequate support of the globe was also of primary concern. A nasal antrostomy had been done previous to insertion of the antral pack in order to permit immediate closure of the oral incision.

Postreduction roentgenograms showed the left zygomaticofrontal and zygomaticomaxillary suture line to be supported in a good anatomic position by wire fixation. The orbital floor had been elevated, and the orbital cavities were symmetrical in contour and size. The left antrum was anatomically satisfactory in position and alignment (Fig. 10, below left).

On the twenty-eighth postoperative day the patient was returned to a duty status. The facial fractures had healed in good position, and other than a slight residual infraorbital edema, the patient was asymptomatic (Fig. 10, below right). The occlusion of the teeth and condylar mobility was normal. The eye level was symmetrical, with no diplopia in the cardinal fields of gaze, and there was normal visual acuity and ocular motility.

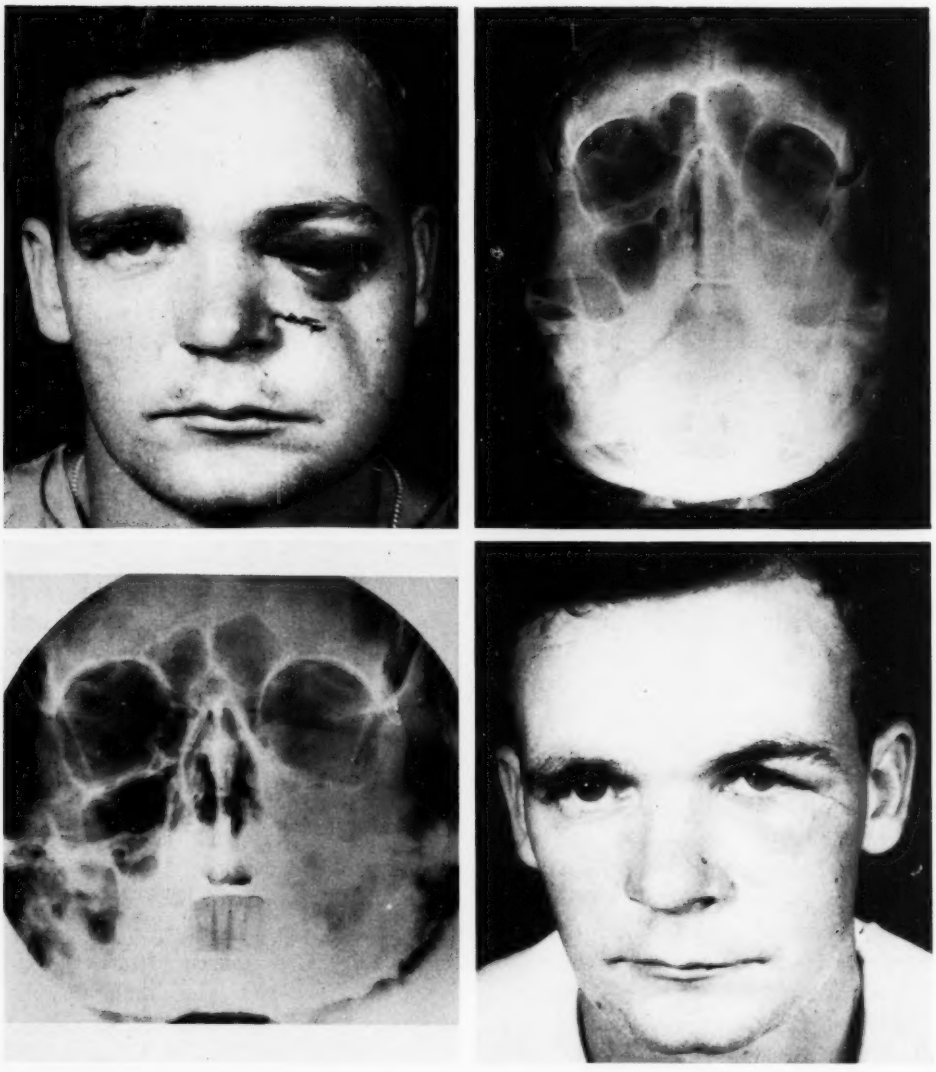

Fig. 10—Case 3. Above left: Preoperative view of patient showing facial deformity and depression of left malar eminence. Above right: Preoperative roentgenogram showing downward and medial dislocation of zygoma into antrum, with separation at left zygomaticofrontal suture line. Note abnormality in size and contour of left orbital cavity with step along inferior orbital rim. Below left: Postsurgical view after elevation of left zygoma from antrum, with direct wire fixation at zygomaticomaxillary and zygomaticofrontal suture lines. Below right: Postoperative appearance of patient on completion of treatment

■ *Conclusions*

1. Roentgenography is an invaluable aid in the treatment of zygomatic fracture-dislocations in conjunction with bimanual palpation of the entire orbital ring.

2. A thorough intraoral examination may reveal traumatic bony deformities and abnormalities of occlusion not otherwise recognized.

3. Condylar mobility in the protrusive and lateral excursions of the mandible, as well as in the open and closed positions, should never be overlooked, if functional disturbances are to be avoided.

4. Definitive treatment of soft tissue injuries and facial fractures should follow within 24 to 48 hours the physical evaluation and clearance by the ophthalmologist and the neurosurgeon.

5. Open reduction with direct wire fixation provides an accurate and positive method of treatment, with elimination of cumbersome and unsightly intraoral and extraoral appliances.

6. The cosmetic and functional disabilities associated with fracture-dislocations of the zygoma are distressing. There are few injuries that are of more concern to an individual than those of the eyes and face, which have resulted in poor visual acuity, ocular asymmetry, permanent facial deformity, and lack of condylar mobility.

Use of the Foley catheter in supporting zygomatic fractures

■ *John Paul Jarabak, D.D.S., Camp Lejeune, N. C.*

Displaced fractures of the zygoma can be reduced efficiently by the intraoral, transantral use of an inflated 30 cc. Foley catheter. Occasionally, additional manipulation of fragments is required prior to the inflation of the catheter which is kept in place for seven to ten days. The catheter is removed with ease at the termination of treatment, and oroantral opening usually heals rapidly and without complication.

The zygoma has been described as a diamond shaped bone[1] which contacts the frontal, sphenoid, temporal and maxillary bones. It helps form the orbital and antral cavities and roof of the oral vestibule. It is described by Lesney[2] as a buttress type bone. Trauma to the cheek rarely fractures the zygoma, but is transmitted to

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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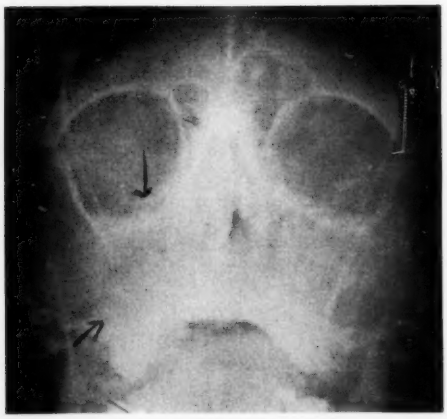

Fig. 1—Preoperative roentgenogram showing depression of the inferior orbital rim and comminution of lateral antral wall with a "step" which can be palpated

weaker parts of the skull. As the trauma is increased, the fractures may extend through the maxilla to the orbital floor and may carry it on to the nasal bones and the ethmoid plates. If the fracture is more severe, the orbital contents may be affected with an intrabulbar ecchymosis. Diplopia, if present, is due to contusion and swelling of the extraocular muscles. The optic nerve may be traumatized or lacerated in severe injuries.

When a depressed zygomatic fracture is present, there usually is comminution of the lateral antral wall and displacement of the inferior orbital rim. The anatomically thinner portion of the face, by virtue of the zygomaticomaxillary suture, infraorbital foramen, inferior orbital fissure and the thin lateral antral wall, is usually damaged first. The author has noted that in most depressed fractures of the zygoma, the lateral antral surface of the maxillary bone is most likely to be comminuted. With the fracture site passing through the infraorbital foramen, anesthesia is usually noted in the upper lip, nose, adjacent cheek, and many times in the anterior maxillary oral mucosa and incisor teeth.

■ *Examination*

The forms of examination which should be utilized to arrive at a proper diagnosis of a fractured zygoma are varied. It is also essential to obtain a thorough history as to the cause and type of trauma. One stage of a careful examination consists of palpation, percussion, and digital evaluation of the "step"[3] (Fig. 1) which may be noted when the finger is passed over the fracture line of the infraorbital rim. Another clinical aid in establishing a diagnosis is the use of tongue blades which are placed in a vertical position, running from the frontal bone over the prominence of the zygoma (Fig. 2, left). With the tongue blades as a guide, a deformity is obvious immediately. The same method may then be used for a postoperative evaluation of the reduction (Fig. 2, right). The clinical signs must be supplemented by adequate roentgenographic examination in the stereoscopic, Waters, exaggerated Waters, and lateral face views.

The eye, being the most vital of the structures involved, should be studied thoroughly by the ophthalmologist for visual acuity, extraocular movements and frequently by funduscopic examination.[3]

Care should be taken to see that the coronoid process of the mandible has not been encroached on or fractured.[4] Limited

3. Leach, T. R.; Martin, B. C., and Trabere, J. C. Diagnosis and treatment of fractures of the zygoma. Int. Surg. Digest 65:300 May 1958.

movement of the mandible will usually indicate this possibility.

■ *Treatment Planning*

In planning treatment, certain questions must be answered. Does the fracture present enough displacement to warrant surgical intervention? What group of the zygomatic contacts are displaced? What degree of comminution is present? Is there blood in the antrum? What is the extent of ecchymosis present? All are important questions which must be answered before proper treatment is decided on.

The many methods of treatment for the various types of fractures have been well classified in the *Manual of Plastic and Maxillofacial Surgery*,[5] and have been demonstrated by Matthews,[6] Crowe,[7] and Waggener.[8] Jackson[9] demonstrated the balloon method by using the intramaxillary sinus pressure balloon, utilizing a wide, intranasal opening.

The use of the 30 cc. Foley catheter (Fig. 3) is similar in its elevation principle to the balloon used by Jackson,[9] but its approach to the depressed zygoma is different. The direct, intraoral, transantral approach has many advantages, as follows:

1. Direct visibility of the fractured bones and the inferior orbital rim is possible which allows visual observation of

4. Jurgens, Paul E. Treatment of maxillary and malar fractures. J. Oral Surg. 14:339 Oct. 1956.

5. National Research Council. Manual of standard practice of plastic and maxillo-facial surgery. Philadelphia, W. B. Saunders Co., 1942.

6. Matthews, G. W. Fractures of zygoma and zygomatic arch. J. Oral Surg. 8:275 Oct. 1950.

7. Crowe, W. W. Treatment of depressed fracture of the zygomatic bone. J. Oral Surg. 10:3 Jan. 1952.

8. Waggener, D. T. Multiple fractures of facial bones: report of case. J. Oral Surg. 5:10 Jan. 1947.

9. Jackson, V. R.; Abbey, J. A., and Glanz, S. Balloon technic for treatment of fractures of the zygomatic bone. J. Oral Surg. 14:14 Jan. 1956.

Fig. 2—Left: Preoperative clinical vertical tongue blade test for depressed right zygoma. Right: Postoperative view shows contact of both tongue blades, touching cheek bones. Triangular shaded area shows anesthesia one month after reduction

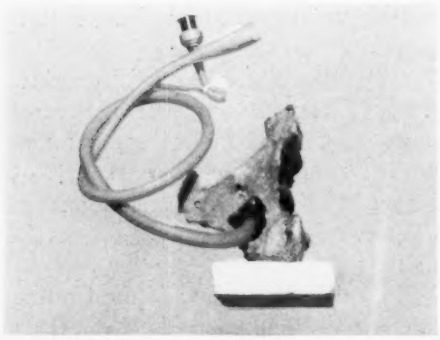

Fig. 3—Inflated 30 cc. Foley catheter filling the antral cavity on a dry specimen

any possible impingement of the infraorbital nerve.

2. Trial attempts to position fractured ends by inflating and deflating the catheter tube can be done at the time of reduction. There are also types of severe fractures that the pressure of the balloon inflation will not reduce. These require forcible reduction, preferably by a thyroid type retractor.

3. After reduction, the fractures can be supported by the inflated catheter.

Further advantages in this method are the constant drainage through the tube of the catheter; no antral pack is required; the tube is well tolerated (Fig. 4, left); after deflation, catheter removal is simple, and no anesthetics or sedatives are required, and oroantral opening heals rapidly (Fig. 4, right). Only once have we experienced herniation of the antral membrane requiring minimal surgical repair.

Occlusal function should be restricted by rubber band traction for the seven to ten day period the catheter is in position. Since the masseter muscle originates along the entire inferior surface of the zygoma and zygomatic arch, it is difficult to conceive that complete stability of the fracture can be maintained if the

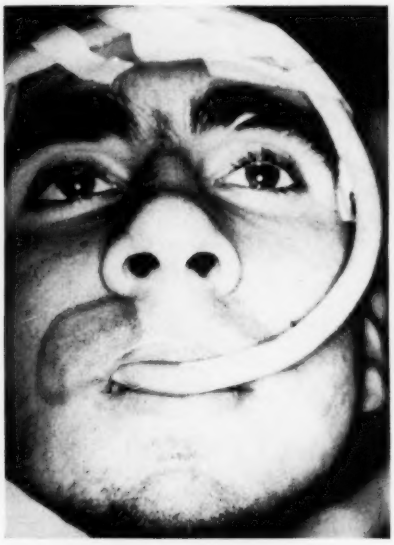

Fig. 4—Left: Demonstration of ease of tolerance of tube to either side. Shaded area shows extent of anesthesia to upper lip. Right: Amount of antral closure on second postoperative day

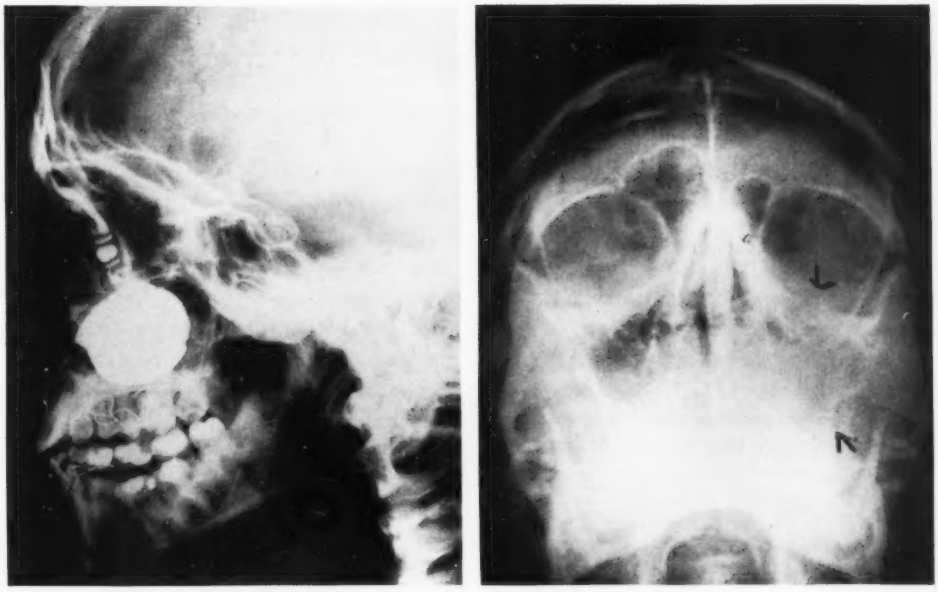

Fig. 5—Left: Lateral roentgenogram showing outline of left maxillary antrum. Right: Postoperative views show satisfactory reduction with inferior orbital rim and lateral antral wall in good alignment. Antrum is now clearing

muscle is allowed to function. The complete, satisfactory filling of the antrum and the support of the depressed zygoma may be seen in the radiopaque outline of Figure 5, left. Postoperative roentgenograms of a patient show the satisfactory results attained after intraoral, transantral, Foley catheter reduction (Fig. 5, right).

■ *Summary*

The 30 cc. Foley catheter, inflated with either air or water, when used in the reduction and support of zygomatic fractures, affords a relatively easy method to elevate and stabilize such fractures. It is kept in place for seven to ten days. The intraoral, transantral approach exposes the extent of bone displacement to direct visibility. Where manipulation and elevation may be direct, the reduced fracture can then be held in position by pressure within the catheter. This method also allows for the evacuation of the hematoma, and the antrum may also be irrigated and continually drained through the catheter. The ease of the catheter removal, the healing of the oroantral opening, and the good tolerance of the catheter are additional reasons for using this method.

The use of freeze-dried bone for treatment of nonunion after surgical correction of mandibular prognathism

■ *Raymond F. Huebsch, D.D.S., Philadelphia*

Nonunion of the fragments in bilateral osteotomy sites in the body of the mandible occurred in two patients who had previously had surgical correction of mandibular prognathism. In each instance, union finally was obtained by grafting freeze-dried bone into the region. In one of the patients, a grafting procedure had failed previously apparently because both the size of the graft and postoperative immobilization were inadequate. Prolonged administration of antibiotics and supplemental vitamins are thought to be helpful during the postoperative period.

"Failure is instructive. The person who really thinks learns quite as much from his failures as from his successes." (John Dewey).

If one does enough surgery, failures are bound to occur. Unfortunately, for the benefit of those learning, who might profit by the mistakes of others, these failures are seldom discussed, much less published. The following case reports are presented to demonstrate complications and ultimate failures which arose subsequent to surgical correction of mandibular prognathism performed in the body of the mandible, as well as those following bone graft surgery, and to report how each was managed.

■ *Case 1*

A 27 year old white man was admitted to the U. S. Naval Hospital, Philadelphia, on May 1, 1955, with the diagnosis of malocclusion. After routine clinical, roentgenographic and laboratory examinations, bilateral ostectomies performed in two stages were decided on as the treatment of choice to establish normal occlusion. On May 9, 1955, the first stage of this procedure was performed intraorally, under local anesthesia. The postoperative course was essentially negative. On May 20, maxillary and mandibular cast gold arch bars, previously fabricated from study models, were wired to the teeth. On May 23, bilateral mandibular ostectomies were performed extraorally, under general anesthesia. A single transosseous wire was used in each side of the mandible to secure the fragments.

The patient's postoperative course was uncomplicated until July 20, when it was observed that there was a lack of prominence at the angles of the mandible. At this time, roentgenographic examina-

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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tion revealed the posterior fragments were superiorly displaced and that there was no evidence of union. Clinical examination on removal of the intermaxillary fixation revealed considerable mobility at both sites of the mandibular ostectomies.

Intermaxillary fixation was reapplied until August 29, when it was removed once again to reveal an open bite and pseudoarthroses at the ostectomy sites. Roentgenographic examination at this time disclosed eburnation at the ends of the fragments, and the indications of bilateral nonunion (Fig. 1). Approximately 1.5 cm. of bone had been resorbed at the ostectomy sites. Both incisions were well healed, and at no time throughout the postoperative course was there any sign of infection. Obviously, this procedure had been a failure; the mandible lacked continuity bilaterally, which resulted in an open bite. Consultation with the medical service ruled out systemic disease as the causative factor for the nonunion.

On October 29, 1955, preparations were made for bone graft surgery on the mandible. An aspetic technic was used, and two strips of freeze-dried iliac bone were cut from measurements of the roentgenograms for inlay-onlay type grafts, each of which measured approximately 8 by 2.25 by 0.75 cm. The sides which were to be placed in apposition with the fragments of the mandible were decorticated. In order to ensure a rich blood supply throughout the grafts, the cortical bone on the lateral surfaces was fenestrated with a bibeveled bur. After this procedure, the

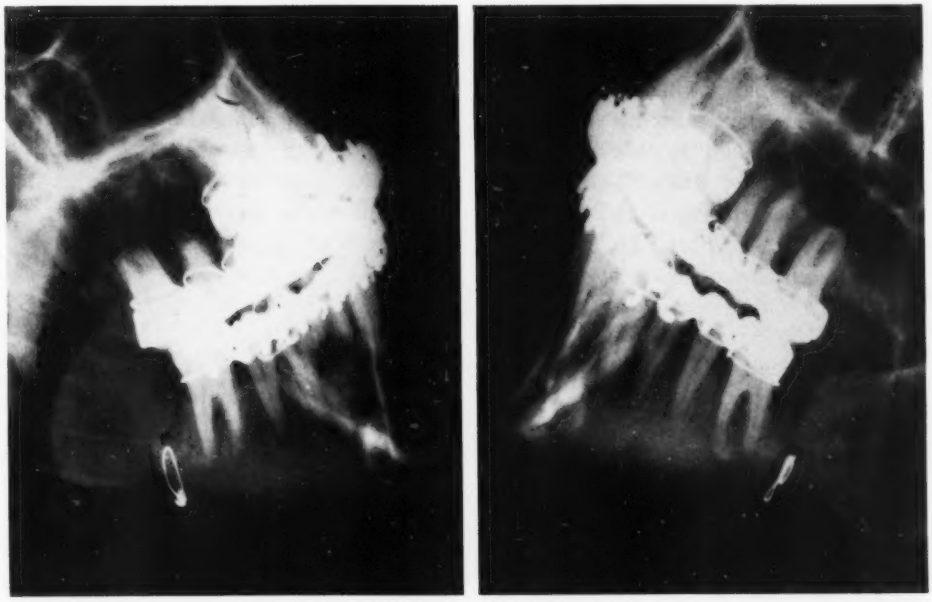

Fig. 1—Case 1. Roentgenograms three months postoperatively showing resorption and eburnation of fragments and bilateral nonunion

grafts were placed in a streptomycin and penicillin reconstituting solution for 48 hours.

On October 31, the patient was taken to surgery. The following operation was performed under general anesthesia with intranasal, endotracheal intubation.

The mandible was immobilized in the correct occlusal relationship by intermaxillary wiring of the arch bars. Then the patient's face was prepared and draped in the usual manner. The scar remaining from the previous operation was excised and the incision was extended to 8 cm. in length, about a centimeter inferior to and parallel to the body of the mandible. The underlying platysma muscle was cut and the incision was carried through the periosteum to the mandible. The bleeders were tied and the external maxillary artery was identified, clamped, cut and ligated. The soft tissue and periosteum were reflected, exposing the proximal and posterior mandibular fragments which were connected with dense fibrous tissue. This tissue, together with the inferior alveolar nerve and vessels, was excised and the fragments were trimmed and placed in their proper alignment. The fragments were decorticated on the lateral aspect with a vulcanite bur and Stryker saw until the bony surfaces were bleeding freely in the regions to be in approximation with the graft.

Physiologic saline irrigation was used during this procedure to debride the regions and to prevent excessive heat. Holes were drilled in the superior portion of each segment and .018 inch stainless steel wires were inserted. The previously prepared freeze-dried bone graft was fitted to the defect. Holes were placed and the wires were inserted through the inferior portion of both segments and graft. The wires were twisted and tightened in a criss-cross pattern, firmly binding the graft and fragments.

The wound was closed primarily in layers and Xeroform gauze and a pressure dressing were applied. The same procedure was performed on each side. The fluids lost during the surgical procedure had been replaced by 500 cc. of whole blood and 500 cc. of 5 per cent dextrose and water through an intravenous infusion.

Directly after surgery the intermaxillary wires were replaced with elastics, to permit the immediate opening of the mouth in case of nausea. Then when the patient recovered fully from the anesthesia, the wires were replaced. High blood levels of penicillin and streptomycin were maintained for one month postoperatively. The patient was given massive doses of vitamins A, B complex, C, and a high caloric, high protein liquid diet throughout the postoperative course. The patient's convalescence was uneventful. The mandible was maintained immobile for eight weeks and five days, after which time there was clinical and roentgenographic evidence of union of the grafts bilaterally. The occlusion of the teeth was equilibrated (Fig. 2). The patient had no complaints and was able to eat a regular diet.

On June 24, 1957, 18 months postoperatively, the patient was seen and he was jubilant with the results. The surgical scars were almost invisible. Roentgenograms of the mandible revealed the grafts completely consolidated with the fragments (Fig. 3).

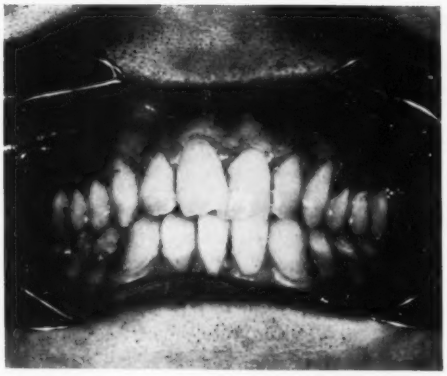

Fig. 2–Case 1. Postoperative view showing occlusion of teeth after equilibration

■ *Case 2*

A white man, 26 years of age, was admitted to the U. S. Naval Hospital, Philadelphia, on July 10, 1956, to undergo a bone graft operation for correction of nonunion of the right side of the mandible. Prior to admission here, a two-stage ostectomy in the body of the mandible, similar to that performed for Case 1 (except that criss-cross transosseous wires were used to secure the fragments) had been performed at another hospital for correction of mandibular prognathism, which had resulted in bilateral nonunion. While at the other hospital, two bone graft operations had been performed to correct these defects. The first, using freeze-dried cancellous bone chips, resulted in bilateral nonunion. The second, using autogenous bone grafts from the iliac crest (Fig. 4), resulted in nonunion of the right side of the mandible and union with malposition of the fragments of the left side of the mandible.

Complete physical examination, laboratory investigations and roentgenographic studies at the time of admission were within the limits of normal with the following exceptions: nonunion, resorption of the fragments and graft, and a nonvital second bicuspid tooth involved in the border of the proximal fragment (Fig. 5), and a chronically draining fistula of the right side of the mandible; union with malalignment of the fragments, and a surgical scar of the left side of the mandible; and numerous mobile teeth and gingival recession of the lower anterior teeth.

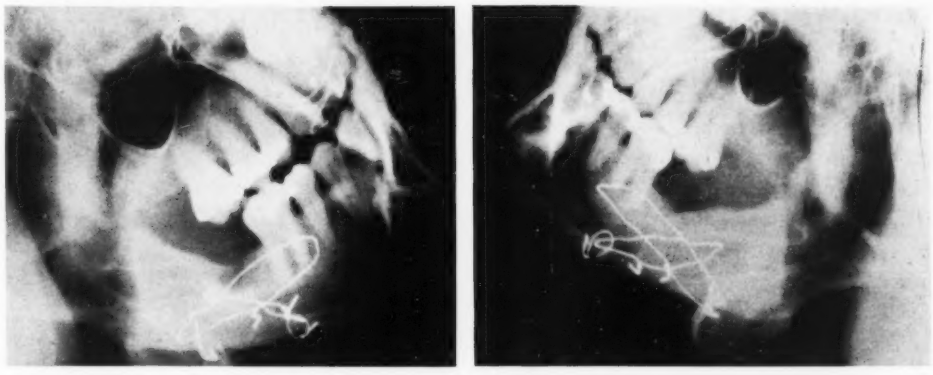

Fig. 3–Case 1. Eighteen months postoperatively. Consolidation of grafts with fragments can be seen

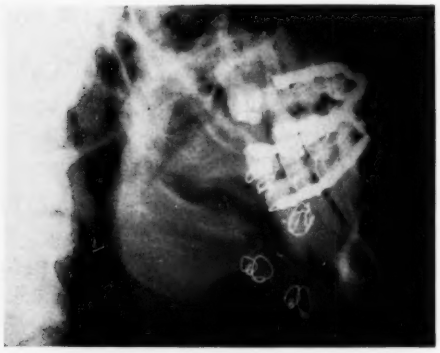

Fig. 4—Case 2. Postoperative view of left side of mandible showing inadequate autogenous bone graft. Fragments are malaligned. Mandible was not immobilized prior to surgery

A complete medical evaluation ruled out any possible systemic disease as the cause of the nonunion. Culture and sensitivity tests performed on the exudate from the fistula determined the infecting organism to be *Staphylococcus albus*. Chlortetracycline was revealed to be the antibiotic of choice and therapy was instituted. Meanwhile, impressions were taken of the dental arches. Cast gold arch bars were constructed from the study models. The mandibular second bicuspid was extracted from the proximal fragment under local anesthesia.

By August 8, drainage from the fistula had diminished. Under nasal, endotracheal general anesthesia, a sequestrectomy was performed on the fragments of the right side of the mandible, and the arch bars were applied to the teeth for future immobilization of the mandible. After all signs of the chronic infection had subsided for two months, the patient was considered ready for bone graft surgery.

On November 13, using an aseptic technic, two strips of freeze-dried iliac bone were fashioned into an inlay-onlay type graft. The inlay portion measured 2 by 2.5 by 0.75 cm., representing the size of the defect as determined roentgenographically. This was centered on and secured to the onlay portion by interosseous wiring, using .014 inch stainless steel wire. The onlay portion measuring 8 by 2.25 by 0.75 cm. was decorticated on the side to be placed in apposition with the body of the mandible on either side of the defect. In order to ensure a rich blood supply throughout the graft, the cortical bone on the lateral surface was fenestrated. The graft was placed in the prescribed reconstituting solution for 48 hours after this procedure.

Fig. 5—Case 2. Right side of mandible four months postoperatively. Nonunion, resorption of fragments and graft and nonvital second bicuspid involved in border of proximal fragment can be seen

On November 15, under nasal, endotracheal general anesthesia, intermaxillary wires were placed between the arch bars for immobilization of the mandible in the correct occlusal relationship. The patient's face was prepared and draped according to the accepted procedure and the previous scar was excised and the incision was extended to 8 cm.

Sharp and blunt dissection was used and the proximal and posterior bone fragments were exposed. The bleeders were tied off. The fragments were freed buccally and lingually to gain access for the graft and to allow passage of the interosseous wires. The lateral surfaces of the fragments were decorticated with a Stryker saw in the regions to be in approximation with the graft. The graft was held in place with bone forceps, and holes were bored near each end of the graft at its superior and inferior aspects, which extended through both the graft and the fragments of the underlying mandible. Normal saline irrigation was used during these procedures.

Stainless steel .018 inch wires were passed through the holes in a criss-cross manner along the length of the graft and the free ends were twisted and tightened on the lateral surface. Good fragment apposition with the graft was attained. The wound was closed primarily in anatomic layers and Xeroform gauze and a pressure dressing were applied. Intravenous infusion of whole blood and 5 per cent dextrose in water were used to replace the fluids lost in surgery. The same postoperative orders were prescribed as for Case 1.

On January 11, 1957, when the intermaxillary fixation was removed there was clinical and roentgenographic evidence of union of the graft with the fragments of the mandible. The occlusion of the teeth was equilibrated (Fig. 6, left). The patient had no complaints and was able to subsist on a regular diet.

The patient was seen in July 1957, eight months postoperatively. He had improved immeasurably, physically and psychologically, and had reenlisted in the

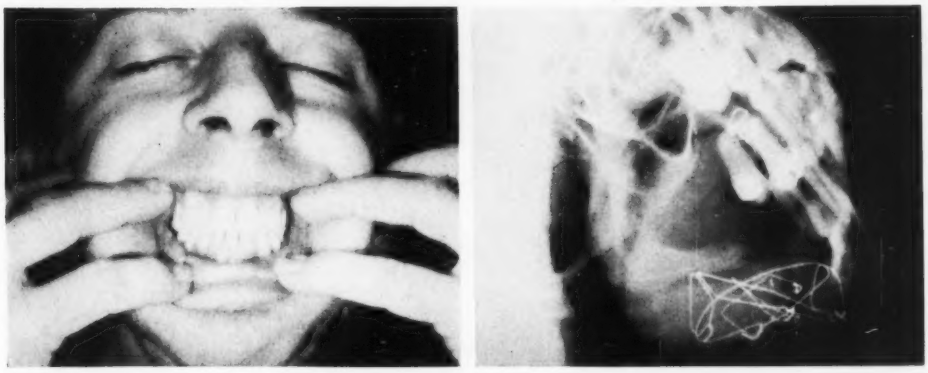

Fig. 6–Case 2. Left: View of teeth after equilibration of occlusion. Right: View of graft eight months postoperatively showing bridging of bone between graft and fragments

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Navy. His mandible was healed with good cosmetic results and normal function (Fig. 6, right).

■ *Conclusions*

The nonunion after the ostectomies of the mandible in Case 1 might be attributed to the use of only a single transosseous wire in each side of the mandible to secure the fragments. However, in Case 2, even though criss-cross transosseous wires were used for this purpose, nonunion occurred after the identical procedure and without the presence of infection. In both cases, during surgery, it was observed that the mandible was very dense and minimal bleeding of the bone occurred on sectioning. Consequently, these operations resulted in an aseptic necrosis from pressure of the distal fragments at the ostectomy sites, and ultimately nonunion and malalignment of the fragments occurred.

In retrospect, if there had been a tooth in occlusion in each of the distal fragments to prevent superior displacement, this complication might not have occurred. It is the writer's opinion that the nonunion occurring in this type of surgery is not necessarily due to poor surgical technic, but is a complication that might occur. It is a risk the patient and surgeon must understand and accept. It is thought that the bone grafts were successful in both instances because of the greater surface contact of the graft to the fragments than existed at the ostectomy sites of the original surgery.

Also, the first autogenous bone graft procedure failed in Case 2 because the size of the graft was inadequate, the mandible was not immobilized prior to surgery, and the fragments were not aligned during surgery.

The final success achieved in these cases is attributed to the following: fenestration of the cortical surfaces of the grafts furnished a better blood supply and enhanced osteogenesis; the size, shape, and immobilization of the grafts were adequate; the high blood levels of antibiotics instituted to prevent infection; the use of vitamins A and C to help stimulate repair and osteogenesis, and vitamin B complex to enhance adequate assimiliation during the prolonged administration of antibiotics.

■ Atomic Energy and Leisure

As manpower is replaced by other sources of energy, especially atomic energy, the entire conception of recreation shifts. What mankind will do with these new leisure hours will determine the value of our culture.—*Morris L. Ernst.*

Cervicofacial actinomycosis: a postextraction complication

■ *Theodore A. Lesney,* D.D.S., San Diego, and Kimble A. Traeger, † D.M.D., U. S. Navy*

It has now been established that actinomycotic infections may occur in patients who have had no direct or indirect contact with cattle. Two cases, occurring in sailors on sea duty, far removed from possible contact with cattle or grasses, are reported. Treatment consisted of incision and drainage when indicated and administration of various antibiotics. However, the most effective medication appeared to be prolonged administration of isoniazid. Both patients recovered completely and have had no further difficulty.

Actinomycosis in the human being is an infection of the fungus group which may follow any operative procedure within the mouth. The somewhat characteristic clinical picture involves infection of the perimandibular tissues, degenerating into granulomatous masses with subsequent abscesses throughout the cervicofacial region on the affected side. The term "lumpy jaw" is commonly used in describing this disease in cattle. A review of current literature suggests that the disease usually is unilateral and only rarely is associated with operations in the maxillary regions. It most frequently appears to be incited by trauma to the tissues surrounding the lower teeth.

This, of course, is not the entire picture of actinomycosis in the human being. The disease has been isolated in the lung field and in the gastrointestinal tract, to mention only two other locations. It has been demonstrated repeatedly in surgically removed veriform appendixes. In this paper, however, discussion will be limited to cervicofacial actinomycosis after dental operations in sailors, as exemplified by two instances.

Over the years, a theory has found favor that this disease was somewhat of an occupational hazard, endemic in farmers, dairy workers, stable workers and others in daily contact with cattle, horses and their feed. So well established has this theory become that the doctor is disappointed if he cannot ascertain that the patient acquired the disease from chewing on a straw that he retrieved from a nearby dairy farm.

It seemed incongruous that sailors at sea, thousands of miles from the nearest cow or hay field, should become infected. It is now established that actinomyces may

The opinions and assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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be normal inhabitants of the mouth, and that they can be isolated from many mouths showing no evident sign of mycotic infection.

The organism producing the disease in man is thought to be an anaerobe. Several strains have been isolated. This article will be confined to the more common actinomyces. Whether the disease produced in man is due to a true anaerobe may be somewhat doubtful. The fact remains that in the bacteriology laboratory, the actinomyces isolated from the human being can be cultured only under anaerobic conditions.

More recently, it has become a trend to consider arbitrarily that actinomycosis in the human being is due to the organism identified as *Actinomyces israelii*. In cattle, the organism is identified as *A. bovis*. Erikson[1] has stated that he considers these as clearly different and distinct species. He studied 12 human and 7 bovine strains of actinomyces and found the two groups to differ consistently in biochemical and antigen reactions. His conclusions are not shared by all bacteriologists. Many other observers consider *A. bovis* and *A. israelii* to be synonymous terms for the same organism.

Although the organism is anaerobic, it appears to survive in the mouth when concealed in dental caries, in deep periodontal pockets and in tonsillar crypts. Actinomyces have been found repeatedly in dentobacterial plaques.[2] Garrod[3] reported successful cultures from seemingly normal saliva. He also found local colonies in 20 out of 70 pairs of excised tonsils.

Actinomycosis is classified as a rare disease, but a considerably large number of cases have been reported in the United States literature. Recently, two patients with cervicofacial actinomycosis were studied and treated in the U. S. Naval Hospital. These two patients were similar in that each was a man, each had been on prolonged sea duty during the onset of the disease, and each had had a dental extraction involving the lower teeth as the circumstantial, inciting cause. In each instance the fungus infection developed on the same side of the face and neck from which teeth had been removed.

■ *Case 1*

A 34 year old Caucasian sailor was admitted to the U. S. Naval Hospital with a chief complaint of persistent, hard swelling of the left side of his face, in the region of the angle of the lower jaw. He was a well-developed, vigorous man with no prior history of hospitalization for disease or trauma.

The patient had had a lower left third molar uneventfully removed under local anesthesia 15 weeks prior to his admission to the hospital. Ten days after the tooth had been removed, the patient had developed some swelling about the angle of the lower jaw, on the same side. He had been seen by a doctor and found to be afebrile and asymptomatic except for the swelling. The swollen mass had become firm and indurated. A course of parenteral penicillin had been prescribed for five days and in that time the swelling

1. Erikson, Dagny. Pathogenic anaerobic organisms of the actinomyces group. Medical Research Council Special Report No. 240. London, His Majesty's Stationery Office, 1940. Cited by Garrod, L. P. (footnote 3).

2. Ennever, J. J.; Robinson, H. B. G., and Kitchin, P. C. Actinomyces and the dento-bacterial plaque. J. D. Res. 30:88 Feb. 1951.

3. Garrod, L. P. Actinomycosis of the lung. Tubercle 33:258 Sept. 1952.

Fig. 1—Case 1. Left: Firm, indurated and persistent swelling over left parotid gland region and submaxillary triangle of neck, typical of cervicofacial actinomycosis before positive diagnosis can be established. Right: Multiple abscesses forming in this typical region contain brownish-yellow pus grossly palpable as granular

became considerably reduced but not completely eliminated.

One month later, or 40 days after tooth extraction, the swelling had recurred in the same location with slowly progressive enlargement. He again had been given antibiotics but this time the treatment was without clinical evidence of benefit. He was periodically observed and treated locally for about 15 weeks before the opportunity for transfer to a hospital arose. In the meantime, he felt perfectly well except for his swollen jaw and he reluctantly accepted transfer to the hospital.

Upon admission he was slightly febrile (temperature 99° F.). Otherwise the results of the general physical examination were within normal range except for the swollen jaw. Routine laboratory examinations (chest roentgenogram, urinalysis and blood studies) were negative for disease. The detailed examination of the symptomatic region revealed a firm, nontender, indurated mass over the left submaxillary triangle of the neck (Fig. 1, left). Flow of saliva from the ducts of the parotid and submaxillary glands was abundant and unobstructed. Primary differential diagnosis was concerned with establishing this condition as infection or neoplasia. Since the history suggested secondary infection, this consideration was investigated first.

Needle aspiration of the mass was performed on the day of admission, and about 0.5 cc. of bloody exudate was submitted to the laboratory for direct smear and culture examination. This report indicated mixed infection with hemolytic *Staphylococcus albus* as the predominant organism. Sensitivity-disk testing determined the infection to be sensitive to chlortetracycline, bacitracin, dihydrostreptomycin, erythromycin and tetracycline.

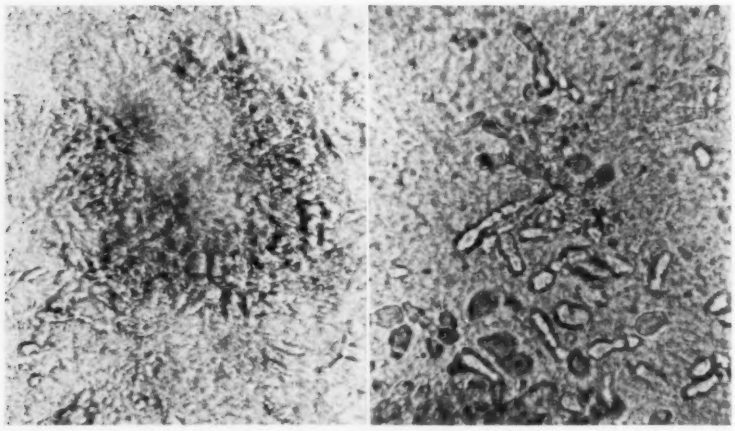

Fig. 2—Left: Unstained "sulfur granule." This represents a colony of actinomyces arranged in typical "sun ray" effect. Right: Higher magnification at periphery of so-called sulfur granule. Note club-shaped form of actinomyces

No effort was made at this time to isolate fungus. Tetracycline was prescribed for ten days without demonstrable benefit. Needle aspiration was repeated and the bacteriologic examination suggested that the mixed infection was responding to treatment despite the fact that the swollen mass had not changed objectively in character.

Seventeen days later, the mass softened and localized as illustrated in Figure 1, right. It was now obviously an abscess. Incision and drainage produced large quantities of pus containing brownish-yellow granules. Microscopic examination of these granules established them as "club-shaped" organisms arranged in the somewhat typical "sun ray" pattern of actinomyces (Fig. 2). Culture of the exudate permitted isolation of actinomyces arbitrarily identified as *A. bovis* by the bacteriologist. The fact that the disease was present in a human being perhaps should have dictated that the organism be termed *A. israelii,* but such differentiation is only of academic importance.

The clinical course of the disease was chronic. Subsequent granulomatous masses developed in the cervicofacial region on the left side, and these degenerated into abscesses with draining fistulas on the skin surface. Each newly formed abscess was incised and drained.

Varied combinations of recommended antibiotics were attempted but none appeared to result in any remarkable benefit. After repeated and persistent disappointment with antibiotic medications in this particular problem, and because of the benefits reported with the use of isoniazid in similar instances, it was decided to attempt a course of this medication.

Dosage of isoniazid was 200 mg. three times per day for 15 days. Dependent drainage was continued as long as it was productive. Response to this treatment appeared to be better than that to other

medicaments previously employed. The granulomas were slowly resolved, and drainage was continued until complete disappearance of each mass. Repeated examinations of the discharges from the sinuses were positive for so-called sulfur granules. Microscopic evaluations persistently demonstrated ray fungus. During the final seven weeks of hospitalization, progressive clinical benefit was evident. The bacteriologic picture of the infection became altered. Fewer actinomyces and more staphylococci and streptococci were seen with the symptomatic improvement of the patient.

After five months' hospitalization, the patient appeared to be cured (Fig. 3). There was no further evidence of suppuration or development of new granulomas. A final, direct smear was negative. Chest survey ruled out any aspiration metastasis. The total duration of this disease appeared to have been about nine months.

Fig. 3—Case 1. Patient after cure of cervicofacial actinomycosis with use of isoniazid medication and surgical drainage

■ *Case 2*

A 17 year old Caucasian sailor was admitted to the U. S. Naval Hospital. His chief complaint pertained to a persistent, hard swelling of the right side of his face after tooth extraction (Fig. 4, above left). His past history was essentially noncontributory. He had been hospitalized on two previous occasions, but these were for tonsillectomy and for the treatment of fractures of nasal bones, and these episodes had occurred more than ten years previously.

About three weeks prior to this admission to the hospital, he had had four nonrestorable, lower right posterior teeth removed. This procedure had been carried out with the patient under local anesthesia and had been reasonably uneventful. His postoperative course had not been remarkable until a few days prior to admission when a progressively noticeable firm swelling localized in the region of the right parotid gland had developed. Prior to his admission to the hospital he had received penicillin, streptomycin and oxytetracycline in undetermined dosage.

When the patient entered the hospital, his body temperature was 98.8°. The results of blood studies, urinalysis and chest roentgenograms were considered within normal range. The major finding in the examination was a firm mass spread over the region of the right parotid gland. All postextraction wounds had healed satisfactorily except in the lower right first molar region. This appeared to be healing at a slower rate. Except for the swollen mass in the right side of the face, the patient had no other com-

plaints and no other immediate findings were elicited. Salivary flow from all ducts was abundant and of low viscosity. Sialolithiasis was easily ruled out.

The patient was persistently afebrile. Unilateral parotitis was eliminated from consideration after study. Attempted aspiration of the mass was nonproductive. Direct smears for examination and culture were taken from deep within the slowly healing tooth alveolus noted previously. The report of the examination was:

> Mixed organisms compatible with those seen in oral fluids. Predominant clusters of hemolytic staphylococcus sensitive to chlortetracycline, erythromycin, chloramphenicol, penicillin and bacitracin.

Studies for fungus infection were not made at this time. Treatment with chlortetracycline was commenced with 500 mg. and continued with 250 mg. every six hours for ten days. There appeared to be no beneficial response to this medication. A second culture indicated similar sensitivity of the flora to the same antibiotic drugs previously ascertained. This time erythromycin was used in the same dosage, and for the same period as previously employed with chlortetracycline. The results were again disappointing. At this time, chloramphenicol was substituted for erythromycin in similar dosage and continued for 15 days.

Finally, in the patient's sixth week of hospitalization, the facial swelling started to change in character. It slowly softened and became a localized fluctuant abscess just below the angle of the mandible (Fig. 4, above right). The abscess was incised and drained of profuse amounts of brownish-yellow, granular pus. This was examined by palpation and by visualization with a hand lens. The pus was strongly suggestive of sulfur granules. A specimen was sent to the bacteriology laboratory for anaerobic culture and was found to be positive for actinomyces.

This examination and retrospect evaluation of the course of the infection substantiated the diagnosis of actinomycosis. Throughout the course of this episode, the patient received, at the hospital and elsewhere, penicillin, chlortetracycline, erythromycin, chloramphenicol, oxytetracycline and streptomycin, but without cure.

On about the twelfth week of hospitalization the patient was given a course of isoniazid medication; 600 mg. of isoniazid was given in divided doses. Response to this therapy appeared to be progressively favorable. The granulomatous mass started to resolve and all suppuration ceased on the twenty-fifth day under isoniazid medication. The patient was followed for another 30 days during which time it was established that the disease had not involved any regions other than the right cervicofacial region. Chronologic summation of this case history suggests that the disease persisted for almost five months (Fig. 4, below).

■ *Diagnostic Comments*

In each case differential diagnosis was difficult. Nonspecific, residual infection was suspected until suppurating sinuses developed and the exudate was analyzed for fungus infection.

The disease appears to make itself evident first as a firm, hard swelling, not unlike that seen in postextraction trauma and secondary infection. In each instance

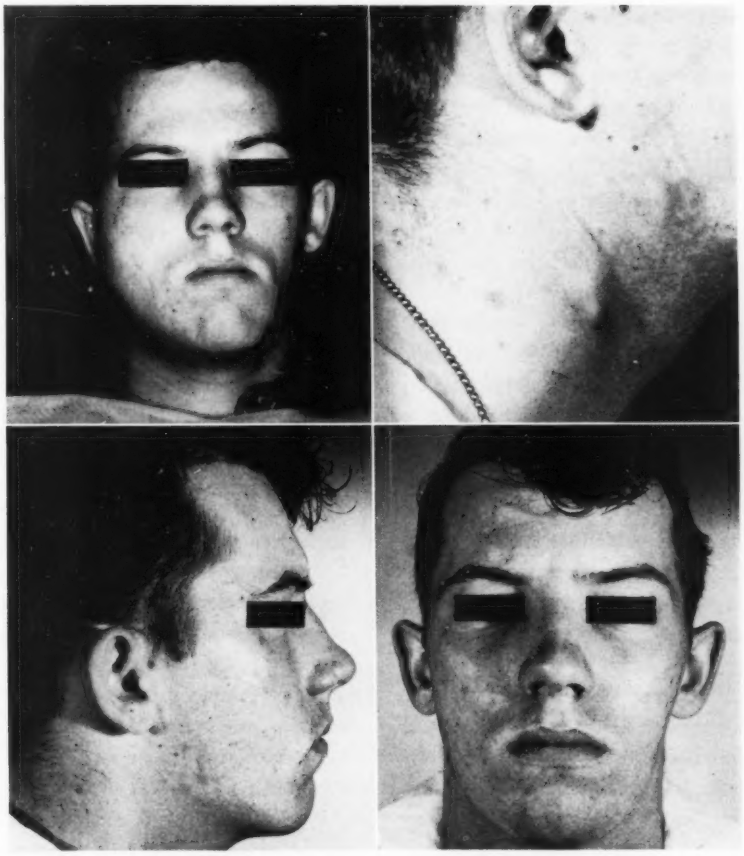

Fig. 4—Case 2. Above left: Fixed, hard swelling over parotid gland, right side, after extraction of multiple lower teeth. Above right: Multiple abscesses of actinomycosis spreading throughout cervicofacial region. Below left: Abscesses requiring incision and drainage as they formed. Below right: Cured patient after five month episode of cervicofacial actinomycosis

the mass is persistent and there is extensive induration. The patient may otherwise appear to be asymptomatic. Subsequently, granulomatous change takes place and lymphadenopathy may be evident on the affected side. Over a period of weeks, the granulomas change into abscesses with multiple, draining fistulas. Prior to abscess formation, specific diagnosis may be difficult. There was no remarkable malaise or temperature elevation in these two instances. However, a low grade fever, an elevated sedimentation rate and leukocytosis with neutrophilia are commonly seen in this disease.

Clinical examination of the suppura-

tive exudate is important. A valuable diagnostic feature is the presence of sulfur granules which may appear grossly as dull white to light brown in color. Of course, these granules are actually colonies of mycelia. They are usually about 2 mm. in diameter but vary somewhat in size. A hand lens may be used to advantage in examining the specimen. If the pus specimen is of thick consistency, it should be diluted with water. The granules then will settle to the bottom of the container and may be seen easily. These colonies of organisms (sulfur granules) should not be mistaken for caseous material or other end products of infection without further investigation.

Microscopic examination of the granules is the next procedure in establishing diagnosis. Such microbiologic determination is considered reliable. A loopful of the specimen is crushed on a slide under a cover glass and examined. The characteristic sulfur granules appear as lobulated bodies surrounded by club-shaped structures having tails of interwoven filaments—somewhat resembling the illusion of sun rays, thereby acquiring the name of ray fungus. The specimen is further stained by Gram's method, and the gram-positive, branching filaments are identified. It should be pointed out, however, that strains of actinomyces isolated from lesions of normal mucous membranes may show wide variations in form and structure.[4]

A biopsy specimen of the abscess wall, or the tract of a draining sinus, will disclose granulomatous changes histologically. Actinomycotic granules dispersed throughout an inflammatory field are considered significant findings. Histologic observations should be substantiated by bacteriologic culture examination.

■ *Treatment Comments*

No evidence has been found to indicate that cervicofacial actinomycosis is contagious. The patient therefore need not be isolated.

All localized abscesses should be incised and dependent drainage provided. Various medications have been used with a wide variation in the degree of success. Prior to modern chemotherapy and antibiotics, saturated potassium iodide had wide usage. Thymol, copper salts, iron salts, arsphenamine, vaccine therapy, roentgen ray and radium therapy have been reported as successful treatment measures over the years.[4] Chemotherapy is in use today for such conditions; of the chemotherapeutic agents, sulfadiazine and sulfisoxazole are considered to be the most effective. Most of the antibiotics have been used and their effectiveness has been reported.[5, 6] However, in the two cases reported here, antibiotics appeared to be of doubtful value. Nevertheless, penicillin is considered by many observers to be the treatment of choice and is recommended in doses of 1,000,000 units per day on a symptomatic basis. From four to eight weeks of such penicillin therapy is recommended by Bennett.[7] Combined antibiotics, such as penicillin and dihydro-

4. Bacterial and mycotic infections of man, Dubos, R. J., editor. Philadelphia, J. B. Lippincott Co., 1948, p. 576-584.

5. Hinds, E. C., and Degnan, E. J. Use of achromycin and neomycin in the treatment of actinomycosis. Oral Surg., Oral Med. & Oral Path. 8:1034 Aug. 1955.

6. Lane, S. L.; Kutscher, A. H., and Chaves, R. Oxytetracycline in treatment of orocervical facial actinomycosis; report of 7 cases. J.A.M.A. 151:986 March 21, 1953.

7. Bennett, D. T. Case of cervicofacial actinomycosis Brit. Med. J. 94:154, 1953.

streptomycin, are preferred in stubborn instances.

Stilbamidine, often used in such infestations as kala-azar, was used successfully in treating actinomycosis by Miller and co-workers.[8] The rationale for using isoniazid in actinomycotic infections is based on its bacteriostatic effect in tuberculosis. As in tuberculosis, the implicated organisms in deep mycotic infection, especially those of the Nocardia group, are acid-fast – and produce granulomatous change. As in tuberculosis, the use of isoniazid, streptomycin or combinations of the two appeared to be worthy of trial. Furthermore, the success of McVay and Sprunt[9] in treating actinomycosis in the human being with isoniazid was another motivating factor.

The recommended dosage differs from that used in tuberculosis. Two to four milligrams per kilogram of body weight, per day, is ordinarily prescribed in tuberculosis. Considerably larger doses of isoniazid varying from 10 to 18 mg. per kilogram per day have been suggested in treating actinomycosis.[9]

Of incidental observation is the fact that very recently, two additional cases of actinomycosis in other than cervicofacial regions were successfully treated at this hospital with combined isoniazid and dihydrostreptomycin therapy.[10]

As with all drugs and medicaments, indiscriminate use must be avoided. Side reactions to isoniazid, such as optic neuritis and optic atrophy, have been reported.[11]

■ *Summary*

1. Actinomyces and some of the related strains (such as Nocardia) are found in asymptomatic mouths and in the pharynx. They survive as anaerobes under dentobacterial plaques, in deep periodontal pockets, under carious dentin and in tonsillar crypts.

2. Cervicofacial actinomycosis is frequently associated with an episode of oral trauma, usually to the mandibular tissues.

3. Diagnosis is difficult to establish until the suppurative stage has been reached and some pus can be examined grossly and microscopically.

4. The disease is usually chronic. Strenuous dietary and supportive measures are indicated. Metastasis by extension to the gastrointestinal tract and the respiratory system is not rare.

5. Reportedly, the best current treatment includes combined antibiotics. The two stubborn, prolonged cases reported in this paper responded to the use of isoniazid.

6. Localized, walled-off abscesses must be drained surgically. Fistulous tracts should be exposed adequately.

7. The prognosis for cervicofacial actinomycosis appears to be better than that seen in other regions of the body.

8. There is no evidence that the disease is contagious. Isolation of the patient is not deemed mandatory.

8. Miller, J. M.; Long, P. H., and Schoenbach, E. B. Successful treatment of actinomycosis with "stilbamidine." J.A.M.A. 150:35 Sept. 6, 1952.

9. McVay, L. V., Jr., and Sprunt, D. H. Treatment of actinomycosis with isoniazid. J.A.M.A. 153:95 Sept. 12, 1953.

10. New, William. Personal communication.

11. Kass, I., and others. Isoniazid as a cause of optic neuritis and atrophy. J.A.M.A. 164:1740 Aug. 17, 1957.

Diagnosis of oral keratotic lesions

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There are three common classes of keratin-producing lesions of the oral cavity. Those that eventually become malignant usually go through one or more transition states before degenerating into cancer. These are illustrated in chart form to clarify the confusion that exists over the multiplicity of terms that are currently in use and in an attempt to set up more definite standards of treatment and thus improve patient care.

The clinician, particularly the oral surgeon, is frequently called on to diagnose and treat keratin-producing lesions of the mouth. These lesions range from benign to malignant types, and the patient cannot be treated properly and safely until the correct diagnosis has been made. Because many of these lesions appear to be similar clinically, this almost always requires a histologic examination of the lesion.

In the discussion of keratotic lesions, a great deal of confusion with respect to terminology sometimes exists between clinicians, between clinician and pathologist, and even between pathologists. This article will point out some of the principal reasons for this confusion, and should therefore lead to a better understanding between clinician and pathologist. Cognizant of each other's interpretation of terms, they will be better prepared to make the correct diagnosis and, of course, to prescribe the proper treatment.[1]

This paper will be limited to a discussion of the diagnosis of those lesions of the oral mucosa whose surfaces are covered, entirely or partially, by that white to pearly gray, leathery, and at times scaly material known as keratin or parakeratin. (It must be kept in mind that these lesions may have additional features, such as ulceration and induration, and that carcinoma sometimes does not produce keratin.) As a group, they will be referred to hereafter as keratotic lesions.

The terms for these keratin-producing lesions are innumerable: keratosis, leukokeratosis, hyperkeratosis, hyperkeratosis simplex,[2] hyperkeratosis complex,[2] nonspecific keratosis, focal keratosis, pachyderma oralis,[3] carcinoma in situ, intra-epithelial carcinoma, epidermoid carcinoma, squamous cell carcinoma, and many others including leukoplakia, which has a different meaning for everyone. No wonder, then, that there is turmoil when this last term and others are used to designate keratin-producing lesions. True, within some institutions, like a school or a

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Captain, Dental Corps, U. S. Navy. Officer education and training department, U. S. Naval Dental School, National Naval Medical Center.

1. U. S. Naval Dental School. Color atlas of oral pathology. Philadelphia, J. B. Lippincott Co., 1956.

2. Orban, B. J., and Wentz, F. M. Atlas of clinical pathology of the oral mucous membrane. St. Louis, C. V. Mosby Co., 1955.

3. Bernier, J. L. Management of oral disease. St. Louis, C. V. Mosby Co., 1955.

Fig. 1—Keratotic area on lower lip. Induration is present and central portion is ulcerated

hospital, there may be general agreement as to the meaning of such a word as leukoplakia. But outside the institution, and in the literature, disagreement almost invariably arises when the subject is discussed by people with different educational and clinical backgrounds. The purpose of this article is not to add terms for keratotic lesions, nor to propose another classification, but rather to reconcile the terms and classifications now in use.

Certain other keratin-producing lesions will not be discussed, because they represent fairly distinct clinical and pathologic entities, and as such are less likely to cause confusion. These lesions include lichen planus, lupus erythematosus, nicotine stomatitis, white sponge nevus,[4] verruca vulgaris, psoriasis,[5] geographic tongue and black hairy tongue.

■ *Method of Reconciliation*

Typical of the lesions under discussion is the keratotic area illustrated (Fig. 1). In this instance a 68 year old man complained of a "sore" on the right side of his lower lip of more than two months' duration. Examination revealed an indurated lesion covered by keratotic patches. The central part of the lesion was ulcerated. Biopsy revealed leukoplakia (classification B) and chronic inflammation. Another biopsy was performed and the same diagnosis was returned. The lesion was treated with antibiotics and then excised. No evidence of carcinoma was found in the surgical specimen.

Without a microscopic examination a definitive diagnosis cannot be made, since the lesion may range from a simple benign hyperplasia to a frank, invasive carcinoma. Proper treatment, of course, cannot be instituted until a correct diagnosis has been made.

A graphic method of reconciling the different terms and classifications is presented (Fig. 2). The user of the chart must imagine progressively severe keratotic lesions ranging from the normal to frank, invasive squamous cell carcinoma. This does not imply that lesions shown on the left side of the chart will necessarily become malignant. When dyskeratosis (histologic evidence of malignancy) is present, however, it must be assumed that at least the potentiality for malignancy exists, and for treatment purposes the lesion must be considered precancerous, that is, one which might proceed to squamous cell carcinoma if no action is taken. The lesions between normal and squamous cell carcinoma are given in three basic classifications, A, B and C, with a few synonyms inserted.

It is readily apparent that, depending on which classification is used, different diagnoses may be presented for precisely

4. Cannon, A. B. White sponge nevus of the mucosa. Arch. Dermat. & Syph. 31:365 March 1935.

5. Levin, H. L. Psoriasis of the hard palate. Oral Surg., Oral Med. & Oral Path. 7:280 March 1954

Fig. 2—Three basic classifications of keratotic lesions. Lesions may be thought of as being progressively severe from left to right. A few synonyms are in parentheses

the same lesion. The problem of multiple diagnoses is further complicated by the use of still more synonyms and by the overlapping of one diagnosis with another (as indicated in the chart by the overlapping lines). This use of two terms for the same condition need not be too important even in the overlapping of the more serious diagnoses of advanced leukoplakia and very early squamous cell carcinoma, because treatment would likely be the same in either instance. Nevertheless, the clinician may justifiably be greatly concerned if one pathologist diagnoses leukoplakia and another cancer. If the clinician understands what each pathologist means by his diagnosis, however, then he can reconcile two apparently unlike diagnoses.

It is necessary to emphasize that these diagnoses should be based on microscopic findings. A short discussion of the histologic criteria follows.

CLASSIFICATION A—In classification A, the term focal keratosis appears. This condition is shown in Figure 3. It should be noted that with the exception of the heavy keratin layer, the tissue is very regular and strongly resembles normal epithelium (Fig. 4). The main feature of normal oral mucosa is its regularity. It can be seen how much one cell is like its neighbor in size, shape and staining characteristics. In normal oral mucosa little or no keratin is produced, and when present, it is confined to a thin layer on

the surface. Focal keratosis, then, is a strictly benign lesion, as there is nothing to be seen that would indicate a malignant process. In Figure 5, however, the orderly appearance of normal oral mucosa is lacking and a few of the histologic criteria of carcinoma have appeared, and for this reason the term leukoplakia is used.

The appearance of microscopic evidence of malignancy in epithelium is known as dyskeratosis (malignant dyskeratosis). Dyskeratosis is a descriptive term, used in the microscopic examination, not a diagnostic term. The criteria for dyskeratosis include some or all of the following:

1. Pleomorphism. Cells of the same type vary in size and shape.

2. Loss of polarity. This term has several connotations, but in dyskeratosis there may be a loss of normal relationship from one cell to another. For example, keratin may form deep in the epithelium near cells of the basal layer (epithelial pearl formation) rather than on the surface, where the normal maturation of keratin takes place.

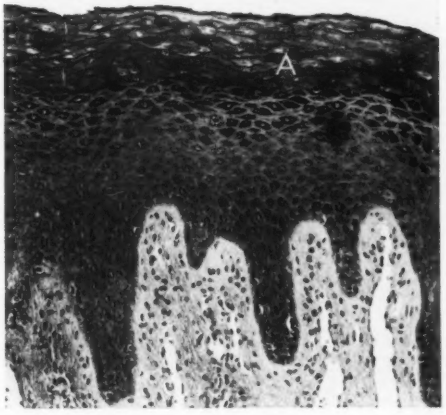

Fig. 3—Focal keratosis (pachyderma oralis, hyperkeratosis simplex). Note heavy keratin layer, A, which appears white clinically. No histologic evidence of malignancy (dyskeratosis) is present. (Hematoxylin and eosin)

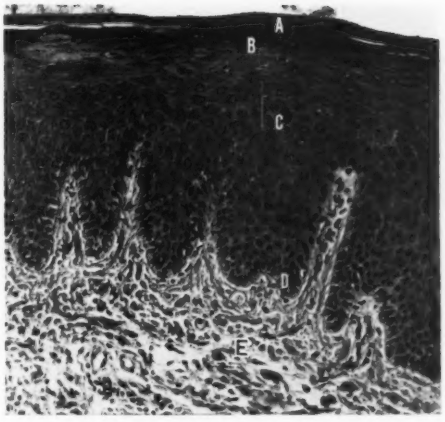

Fig. 4—Normal mucous membrane (palate). Oral epithelium is generally thought of as noncornifying; however, many areas subject to trauma, such as the gingivae and palate, have a keratinized layer, A. B, granular layer. C, prickle cell layer. D, basal cell layer. E, subepithelial connective tissue, or corium. (Hematoxylin and eosin)

3. Prominent nuclei. Nuclei are larger in relation to cytoplasm than in the normal.

4. Prominent nucleoli. Nucleoli are more prominent than in the normal.

5. Nuclear hyperchromatism. Nuclei stain much more darkly than in the normal.

6. Vacuolization of nuclei and cytoplasm.

7. Increased and abnormal mitotic activity. Mitotic figures are seen in normal tissues, but in malignant lesions they are seen more frequently and the chromatin is apt to be arranged abnormally.

The presence of one or more of these characteristics in epithelium is known as dyskeratosis, and its presence to some de-

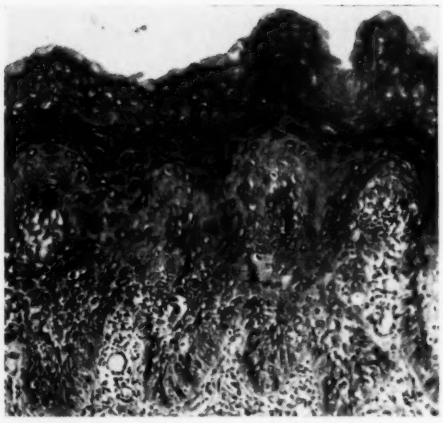

Fig. 5—Leukoplakia (classifications A and B). Compare with Figures 3 and 4 and note appearance of some dyskeratotic change. (Hematoxylin and eosin)

gree is necessary for a diagnosis of leukoplakia in classification A.

In Figure 6 dyskeratosis is present to such a noticeable degree that it appears that squamous cell carcinoma might be present. However, there is no invasion of the underlying connective tissue, and this lesion may be referred to as carcinoma in situ, or intra-epithelial carcinoma.

In Figure 7, too, dyskeratosis is present to a considerable degree, but since there is invasion of the underlying corium, the lesion is known as squamous cell carcinoma.

CLASSIFICATION B—In this classification, perhaps the one most commonly used by American oral pathologists, the term carcinoma in situ is dropped, but the term leukoplakia is used. If there is no dyskeratosis, the term focal keratosis (or a synonym) is used. If dyskeratosis is present without invasion, the term leukoplakia is used (if present to a considerable degree without invasion, the term advanced leukoplakia may be used to indicate the severity of the process, Figure 6). If dyskeratosis is present with invasion, the diagnosis, of course, is squamous cell carcinoma.

CLASSIFICATION C—Some clinicians and pathologists refer to all these noninvasive keratotic lesions as leukoplakia whether or not dyskeratosis is present. This simplification does not give the clinician any clue as to the severity of the disease and the subsequent choice of treatment. Some have proposed to remedy this defect by grading these lesions I to IV.

■ *Discussion*

Even if there were universal agreement as to the selection of one standard classification, there would still be differences of opinion as to where to draw the line between the diagnoses (overlapping lines). For example, how much keratin must there be on the surface of otherwise normal epithelium before the condition is called focal keratosis? Would one questionable dyskeratotic cell justify a diagnosis of leukoplakia rather than focal keratosis? When dyskeratosis is present to a considerable degree, it is sometimes difficult to determine whether or not there is invasion, and different opinions would lead to seemingly conflicting diagnoses, for example, leukoplakia versus squamous cell carcinoma. If the clinician understands the pathologist's criteria for his diagnosis, however, he at once is able to place the lesion in its proper position on the scale from benign to malignant, and any apparent difference in diagnostic terms is relatively unimportant. The

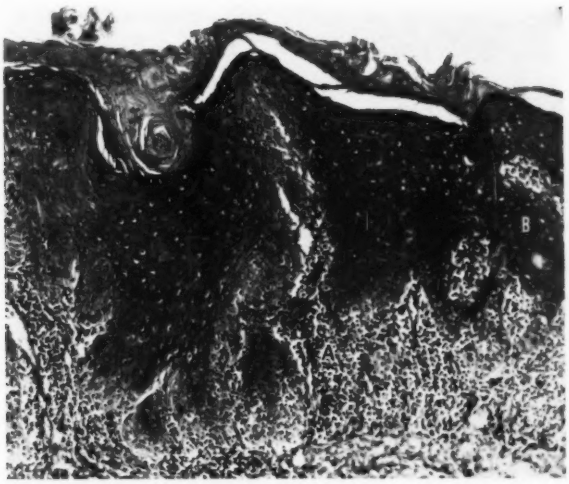

Fig. 6—Carcinoma in situ (classification A). The severe dyskeratosis present is like that seen in carcinoma. Whether or not there is invasion of the corium is partially obscured by heavy chronic inflammatory infiltrate at A. Note early epithelial pearl at B. Lesion may be referred to also as advanced leukoplakia; or if in opinion of examiner invasion has begun, diagnosis of early squamous cell carcinoma would not be in error (classification B). (Hematoxylin and eosin)

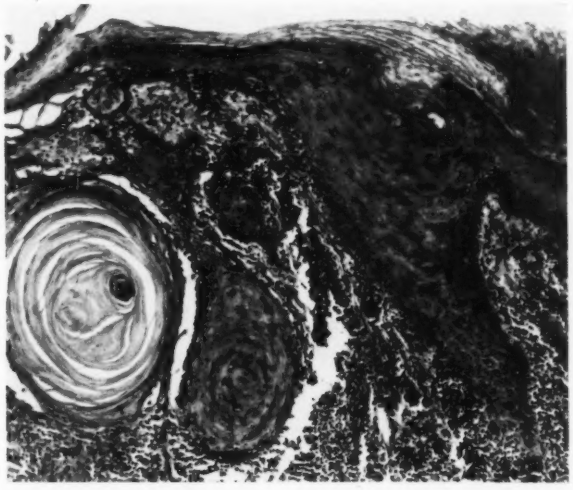

Fig. 7—Squamous cell carcinoma. Severe dyskeratosis is present with invasion of the subepithelial connective tissue. (Hematoxylin and eosin)

clinician may then confidently choose the correct treatment and follow-up for his patient according to the relative severity of the histologic findings.

It is important to realize that the microscopic diagnosis can be made only on the basis of the material submitted to the pathologist. For example, if the diagnosis is focal keratosis or perhaps leukoplakia, there still may be adjoining areas of squamous cell carcinoma in the patient. Therefore, the clinician must remain alert even in the face of a microscopic diagnosis of a benign lesion, and he must submit additional material for examination if the clinical features and history so indicate. In the case illustrated in Figure 6, the lesion had all the histologic features of squamous cell carcinoma except invasion. For this reason, serial sections were made, and in the pathologist's opinion there was no evidence of invasion. Therefore, the diagnosis was advanced leukoplakia. Had the lesion not been excised completely, it would have been impossible to determine whether or not squamous cell carcinoma was present in the adjacent area.

■ *Conclusions*

1. The diagnosis of keratotic lesions can be made with confidence only if it is based on a microscopic examination.

2. Many keratotic lesions appear similar clinically, and those that have not been diagnosed should be referred to by a nonspecific term such as keratotic area or keratotic lesion until a definitive diagnosis has been made.

3. It is obvious that the proper treatment cannot be instituted until the correct diagnosis has been made. This is important in order to prevent inadequate treatment of malignant lesions and overtreatment of benign ones.

4. If leukoplakia and similar terms are used to designate a lesion, it is imperative that the user's exact meaning of the term be understood in order to prevent confusion, particularly when a misunderstanding will work to the patient's disadvantage. For example: Is the term being used as a clinical descriptive term or as a microscopic diagnosis? If the latter, what histologic criteria were used to arrive at the diagnosis?

■ *Summary*

Because of the multiplicity of terms and classifications used in describing keratotic lesions of the mouth both clinically and microscopically, there is frequent misunderstanding and confusion among clinicians and pathologists. Current terms and classifications have been analyzed in an effort to clarify the problem and bring about a better understanding between clinician and pathologist in order to ensure the optimum treatment for the patient.

■ Honor of Science

Science is bound by the everlasting law of honor to face fearlessly every problem that can fairly be presented to it.—*Lord M. H. Kelvin.*

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CASE REPORTS

Management of a subcondylar fracture: *report of case*

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The following is a report of a bilaterally fractured mandible. One of the fracture sites involved the left subcondylar region. The subcondylar fracture was reduced by use of a three finger tantalum plate with Vitallium screws placed through a submandibular approach.

HISTORY—The patient was a 26 year old Caucasian man stationed at the United States Naval Training Center, Great Lakes, Illinois.

On the evening of August 6, 1955, he was involved in an automobile accident. Policemen took the patient to the dispensary at Great Lakes Naval Training Center, from which point he was transferred to the Great Lakes Naval Hospital. He was not unconscious at any time.

PHYSICAL EXAMINATION—On admission the patient was noted to be a well developed, well nourished, mentally receptive white man. There was a laceration of the right forehead and minor excoriation of the frontal scalp. The patient was not able to bring his teeth into normal occlusion. The teeth were in good repair, the lower right second molar being the only missing tooth. Clinical examination by palpation and digital manipulation demonstrated a compound displaced fracture of the right body of the mandible in the region of the first and second bicuspids, and a fracture of the left ascending ramus. Roentgenographic examination confirmed the clinical observations and revealed that the fracture on the left was subcondylar, extending from the sigmoid notch to a point 1 cm. below the neck of the condyloid process. This fragment was displaced laterally and anteriorly, with the condyle being maintained in the glenoid fossa. The remainder of the general physical examination, including laboratory studies, was all within normal limits.

COURSE AND TREATMENT—After the patient arrived at the hospital, he was given 1 cc. of tetanus toxoid and 600,000 units of procaine penicillin intramuscularly. The laceration of the forehead was debrided and closed using five no. 000 Dermalon sutures. The displaced fracture of the right body of the mandible was manually reduced and temporarily immobilized by placing a strand of .020 gauge stainless steel wire around the teeth on either side of the fracture site and twisting the ends together. A modified Barton bandage was placed to assist in immobilizing the mandible until definitive treatment could be carried out.

The following morning, under regional

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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Fig. 1—Roentgenogram taken August 7, one day after application of intraoral fixation appliance

2 per cent lidocaine hydrochloride anesthesia, continuous Stout-type wiring was placed about the necks of the teeth of the four posterior quadrants. The fracture site of the right body of the mandible was incorporated in the continuous wiring of that segment.

After the reduction and immobilization, extraoral roentgenograms were taken which demonstrated adequate reduction of the right body of the mandible, but an overriding and lateral displacement of the left proximal fragment (Fig. 1).

A modified Barton bandage was placed with several pieces of foam rubber over the region of the displacement to assist in bringing medial pressure against the proximal fragment. This was done in an attempt to get bony contact. Two days later another set of roentgenograms was taken which revealed no change in the position of the proximal fragment. At this time the patient was advised that in our opinion an extraoral open reduction of the left subcondylar fracture was indicated.

OPERATION—The patient was anesthetized with intravenous thiopental sodium supported with nitrous oxide and oxygen administered endotracheally through a nasal tube. Succinylcholine chloride was administered by intravenous drip for muscular relaxation.

The left side of the patient's neck and face was scrubbed and prepared for surgery, and after this the patient was draped. The surgical site was infiltrated with 2 per cent lidocaine hydrochloride. The incision was started at a point approximately 1 cm. below the tragus of the left ear, and a little less than 1 cm. posterior to the posterior border of the ascending ramus of the mandible.

The incision through the skin and superficial fascia was carried inferiorly and then anteriorly around the angle of the mandible. The masseter muscle was exposed at its attachment at the inferior border of the mandible. The ligamentous attachment of the masseter muscle was detached, and the muscle reflected superiorly. The external maxillary artery and anterior facial vein were not encountered. The fracture site was visualized and manipulated into correct anatomic relationship. A three fingered tantalum plate that had been prepared previously was placed over the lateral surface, across the fracture site; the single prong over the neck of the condyloid process and the other two facing inferiorly. The tantalum plate was secured by three small Vitallium screws.

The masseter muscle was returned to its bed and sutured to the aponeurosis between the masseter and medial pterygoid muscles, using no. 00 chromatic catgut. The subcutaneous tissues were closed in layers using no.

Fig. 2—Postoperative anteroposterior view showing efficiency of reduction

000 plain catgut, and no. 000000 silk was used on the skin.

Three cubic centimeters of hyaluronidase was injected into the masseter muscle. Nitrofurazone gauze was placed over the wound and a pressure dressing similar to a mastoid dressing was applied. The teeth were placed in their correct occlusal relationship and maintained by placement of intermaxillary elastics. The patient left the operating room in good condition.

POSTSURGICAL COURSE—The patient responded well to the surgical procedure. In the evening after the operation, the pressure dressing was loosened slightly around the neck. Progress roentgenograms were obtained on the eighth postoperative day and revealed the good position of the fragments. Infrared physiotherapy, 15 minutes twice daily, was begun one week after surgery and was continued for ten days.

Progress continued uneventfully until the twentieth postoperative day when the mandibular left first bicuspid gave rise to an acute infection in the fracture line. This was controlled adequately by the intramuscular administration of 600,000 units of penicillin for three days.

Intermaxillary traction was discontinued on September 8, four weeks after the reduction of the fractures. The occlusion remained within normal limits and the patient was able to move his mandible within limited excursions without discomfort. He was discharged from the hospital and sent back to duty one week later (Fig. 2).

A photograph taken on September 13 demonstrating the barely discernible surgical scar is shown in Figure 3. The patient's occlusion was well maintained; a view taken five weeks postoperatively is shown in Figure 4.

Final roentgenograms were taken on April 4, 1956, approximately eight months after surgery (Fig. 5). The fracture sites were no longer visible and the tantalum plate and Vitallium screws were being well accepted by the bone as evidenced by the absence of any osteolytic action. The bicuspid in the line of fracture had received endodontic treatment and was firm and asymptomatic. A photograph taken ten months after surgery illustrates the mandibular excursion in the open position (Fig. 6).

CONCLUSIONS—It was felt that in this particular instance, an open reduction of the subcondylar fracture was indicated. Similar fractures that are displaced laterally are not all handled in this manner for most of them can be managed simply by intermaxillary fixation. In this instance, the fractured neck of the condyloid process was displaced laterally and anteriorly with the inferior edge of the proximal fragment overriding the ascending ramus. The correct anatomic relationship and function could not be re-established without surgical intervention.

Instances in which there is a long condylar fragment should be handled in this manner in preference to the preauricular approach, since the scar is minimal and there is little danger of traumatizing the facial nerve. Furthermore, the approach is simple and the region is readily accessible. If the incision and dissection are carefully planned and carried out, exposure and ligation of the external maxillary artery and anterior facial vein can be avoided.

Postsurgical physiotherapy in the form of infrared or high frequency diathermy is indicated after surgery in this region to assist in preventing muscular trismus.

COMMENTS—When there is lateral and anterior displacement of the proximal fragment in subcondylar fractures, with tissue interposed between the fragments, open reduction should be done in order to restore anatomic relationship and a functional condyle. In most subcondylar fractures the superior fragment is not greatly displaced since the masseter muscle has a tendency to confine it. In such an instance, when the teeth are maintained in their correct occlusal relationship, the overlying edema has a tendency to aid in reduction. Minimal displacement after closed reduction is not of any consequence since the angulation of the condyles in long fractures of this type is usually minimal.

When open reduction is indicated, the use of the three fingered tantalum plate should

Fig. 3—Lateral face photograph, one month postoperatively

Fig. 5—Lateral view showing splint in place, well tolerated by the tissues and holding the fractured fragments in their correct anatomic position

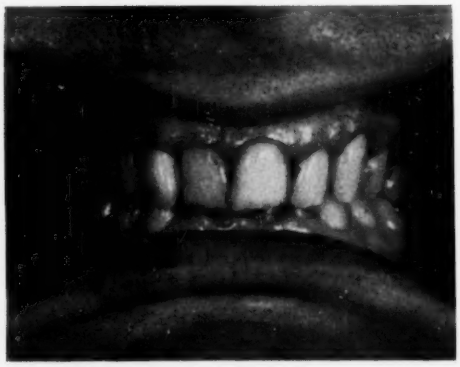

Fig. 4—Five weeks postoperatively. Occlusion is well maintained

Fig. 6—Anterior face view illustrating mandibular excursion in open position

be considered even though most cases can be handled by tranosseous wiring. If the fracture site is high, the plate cannot be employed because of inadequate access, since there is insufficient retraction of the soft tissues to insert the screws. However, when it can be used, the three fingered tantalum plate has the advantage that it is easy to place in position and provides relatively rigid immobilization of the fragments.

Mandibular protrusion: *report of cases*

■ *Harold G. Green, D.D.S., Vista, Calif.*

According to Thoma,[1] developmental deformities of the jaws are those producing a malrelationship between the upper and lower jaw and the middle and lower part of the face. In addition to the cosmetic aspect, there is, in most instances, a decided functional debility associated with the deformity, a malocclusion which prevents proper functioning of the teeth and mastication of food. These deformities are pronounced malformations which either did not have the benefit of orthodontic treatment when amenable or were beyond the scope of orthodontic treatment from the start. The disfigurement may be productive of psychic disturbances, may mar the individual's happiness and may even interfere with normal employment and social success. The treatment of those conditions requires an intensive study of the individual case, great ingenuity, and surgical skill. Two case histories are presented in which a mandibular protrusion and open bite were corrected while bilateral fractures of the mandible were being treated.

CASE 1—On July 1, 1955, a 20 year old marine private received a blow to the anterior portion of the mandible while playing football. A bilateral fracture of the mandible was diagnosed, and the patient was referred to the hospital for treatment. Physical examination revealed a well-nourished, heavy Caucasian man, who was well-oriented and alert, with the vital signs within normal limits. The head and neck were normal in general, except for restriction of mandibular movements. An open bite existed and there was a mandibular protrusion of approximately 1 cm. The maxillary and mandibular teeth were contacting on each side between the upper second and lower third molars. A diagnosis was made of bilateral fracture of the mandible and mandibular protrusion with open bite. Roentgenograms of the mandible revealed a fracture through the angle of the mandible, bilaterally. A lower third molar was located in each fracture line (Fig. 1).

HOSPITAL COURSE—Preparatory to surgery, the patient was placed on antibiotic therapy, and a reduction of the bilateral fracture of the mandible and correction of mandibular protrusion were accomplished in the following manner: A mucoperiosteal flap was retracted in the lower right buccal vestibule, exposing the lower right third molar. The fracture line was observed to course downward and distally through the angle of the mandible. The tooth was elevated from its socket, after which a V-shaped wedge was removed from the mandible

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Captain, Dental Corps, U.S. Navy.

1. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1952, p. 1479.

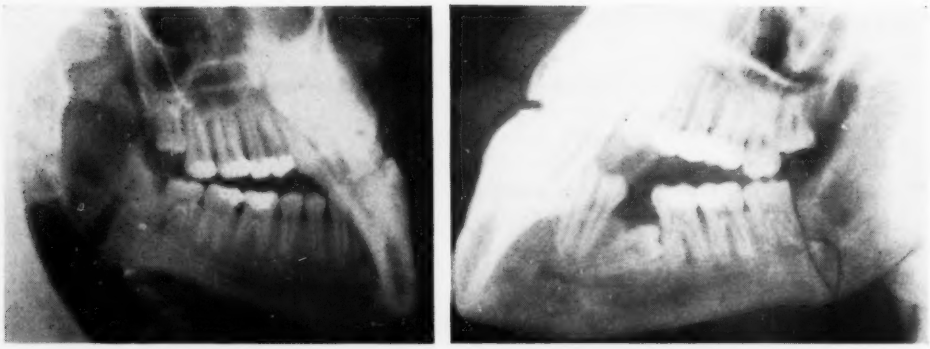

Fig. 1—Case 1. Views showing left and right sides of mandible and illustrating fractures, molar contact, protrusion and open bite

Fig. 2—Case 1. Left: Preoperative view. Right: Postoperative view

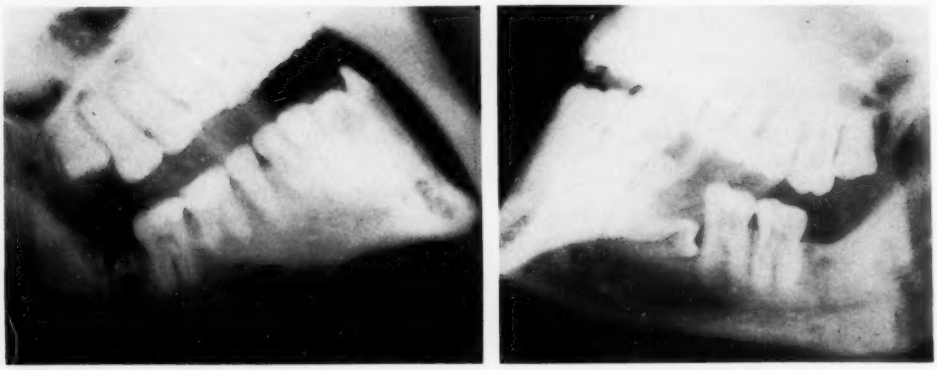

Fig. 3—Case 1. Left and right views of mandible showing healed fractures and new relation of teeth

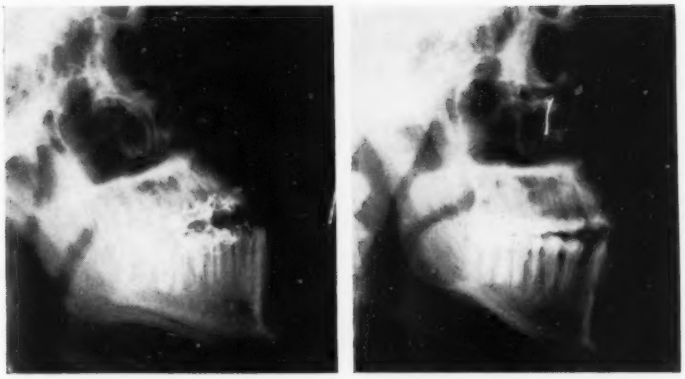

Fig. 4—Case 2. Left: Lateral view showing preoperative mandibular relationship. Right: New position

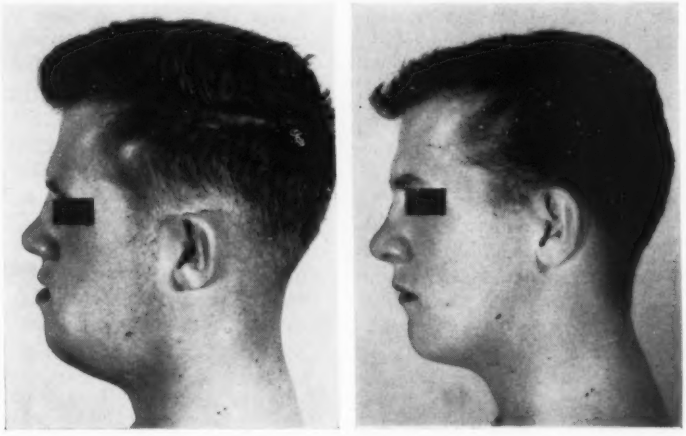

Fig. 5—Case 2. Preoperative and postoperative views showing improved facial appearance

buccolingually, down to the mandibular canal. A similar operation was performed on the left side.

Arch bars were then attached to the mandibular and maxillary arches, and the fractures were reduced by elastic traction. The patient progressed well postoperatively, normal healing resulted, and evaluation at the time of discharge from the hospital revealed improved facial contour (Fig. 2), normal healing of the mandibular fragments (Fig. 3), and full mandibular function. Laminagraphic studies of the temporomandibular joints revealed the condyles to be in their proper positions. There was good functional occlusion of the teeth and correction of protrusion and open bite.

CASE 2—A 17 year old marine private was admitted to the hospital for treatment of a fracture of the mandible sustained when he was struck in the face. Physical examination revealed a well-nourished, well-developed, Caucasian youth in moderate distress, who was oriented and lucid. The vital signs were within normal limits. The head and neck appeared normal, except for swelling of the right side of the face, limitation of mandibular movements and tenderness over the right angle. Within the mouth, the mucosa was lacerated in the lower right vestibule with obvious displacement of the posterior fragment. In the lower left bicuspid region a contusion of the mucosa was noted. There was an obvious mandibular protrusion and open bite, which had been present before the fracture had occurred. Initial impressions were (1) bilateral fracture of the mandible, and (2) mandibular protrusion with open bite. Roentgenograms of the mandible demonstrated a fracture through the right angle with wide separation and involvement of the lower third molar (Fig. 4). Another fracture was noted in the anterior body involving the first bicuspid.

COURSE—After adequate preparation, the patient was brought to the operating room and a reduction of the bilateral mandibular fracture and correction of the protrusion and open bite were carried out. Arch bars were placed in both dental arches. The lower left first bicuspid was removed from the fracture line, and a wedge of alveolar process removed. The lower third molar was removed from the fracture line on the right, and a wedge of alveolar bone was removed in that region. Elastics were applied to reduce the fracture. Adequate fixation was obtained and the patient progressed well. Evaluation at the time of discharge revealed improved facial contour (Fig. 5) and functional occlusion of the teeth. The fractures had healed normally.

COMMENT—Two case histories have been presented in which a mandibular protrusion and open bite were corrected in connection with treatment of bilateral fractures of the mandible. The method described may, with technical improvement, present a way of correcting certain types of protrusion and open bite. Of interest in connection with these cases is the clinical observation that the majority of patients have no conception of their dental occlusion, nor do all patients with developmental deformities wish to have them corrected. Personality and intelligence also should be considered in treating patients with this type of deformities.—*625 Hillside Terrace.*

■ Errors in Research

Four fifths of all the experiments which we make in our physical laboratories in the hope of developing new relations, establishing new laws or opening up new avenues of scientific progress, are found to be directed along wrong lines and have to be abandoned.—*R. A. Millikan.*

Mixed tumor of floor of mouth in a seven year old child: *report of case*

■ *Robert A. Colby,* D.D.S., and Roger G. Gerry,† D.M.D., U. S. Navy*

Benign mixed tumors of salivary gland origin consist of both epithelial and mesenchymal elements. There is dispute as to whether this entity is derived from more than one type of tissue. Some investigators claim that it is entirely an epithelial neoplasm. All, however, accept the term "mixed tumor" as at least being applicable to the histological appearance of the lesion.

The histologic pattern of benign mixed tumors of salivary gland origin varies extremely, both within a single tumor and in different tumors. The epithelial component may consist of round, cuboidal, spindle, stellate, or columnar cells which stain uniformly and are moderately small. These cells may appear singly or be arranged in tubelike structures, small islands, strands, or large masses. The mesenchymal portion of these lesions may be composed of fibrous tissue which is myxomatoid, dense, hyalinized, or loosely arranged. Many mixed tumors contain pseudocartilage, and a few may contain bone. The mathematical possibilities of variation are enormous, and thus it is almost impossible to classify mixed tumors according to histology.

Benign mixed tumors are generally spheroidal and firm to palpation. They are not bound down to the underlying tissue. These neoplasms usually are slow growing and symptomless. The great majority are first discovered during the fourth or fifth decade of life. They may develop wherever salivary gland tissue is located but occur most frequently in the parotid gland. The most common oral sites are the lips and palate. Surgical excision is the treatment of choice. If not completely removed they will recur.

REPORT OF CASE—On December 11, 1957, a seven year old afebrile Caucasian girl was referred to the U. S. Naval Dental Clinic, Yokosuka, Japan, from the pediatric service of the U. S. Naval Hospital because of a mass in the right side of the floor of the mouth.

The mass had been noted first six weeks previously by the patient's mother who stated that it increased and decreased in size and occasionally nearly disappeared. The patient had experienced no discomfort from the enlargement.

PHYSICAL EXAMINATION—Extraoral examination revealed a generalized lymphadenopathy, particularly of the anterior cervical, posterior cervical, axillary, and femoral chains.

Intraorally the patient had a relatively soft, nontender mass in the right side of the floor of the mouth which was not attached to the mandible and which appeared to be above the mylohyoid muscle (Fig. 1). The surface of the enlargement was somewhat lobulated and the same color as the surrounding tissue except anteriorly where it was bluish red. The mass was about 2 by 3 cm. with its greatest dimension parallel and about 1 cm. medial to the lingual surfaces of the right deciduous molars. It was most prominent when the patient fully depressed her mandible and the mylohyoid muscle forced it up into the oral

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Fig. 1—Mixed tumor, floor of the mouth. Upward pressure was applied in the right submaxillary triangle so the tumor mass could be visualized

cavity. When the mandible was not fully depressed the tumor appeared smaller and sometimes could not be visualized at all.

Roentgenographic examination, including posteroanterior and right and left lateral oblique views of the mandible, revealed no abnormalities.

LABORATORY STUDIES—The white blood cell count was 10,400 per cubic millimeter with 42 per cent neutrophils, 52 per cent lymphocytes (a few atypical), 5 per cent eosinophils, and 1 per cent basophils. Hemoglobin was 10.4 Gm. The Davidsohn test for infectious mononucleosis was negative with a presumptive heterophil titer of 1:14.

COURSE AND TREATMENT—On December 12, 1957, an attempt was made to aspirate fluid from the central portion of the mass but none was obtained. The semisolid material that was found in the needle was placed on absorbable gelatin sponge and submitted to the laboratory as a specimen. Histologic examination revealed only red blood cells.

The generalized lymphadenopathy persisted and so on December 19 the Davidsohn test was repeated but with negative findings.

On December 31 a sialogram was considered but neither of the submaxillary ducts could be catheterized.

When the patient was examined on January 16, 1958, the lymph nodes had returned to their normal size. The patient was seen weekly and it seemed at first that the intraoral mass was becoming smaller. In retrospect, however, this false observation was probably related to the degree of depression of the mandible when the lesion was examined.

On February 18, 1958, the patient was admitted to the hospital and under oral endotracheal general anesthesia a yellow, well-encapsulated mass about 2 by 3 cm. was enucleated from the right side of the floor of the mouth through an intraoral incision directly over the enlargement. The tumor lay immediately beneath the mucous membrane and was superior to the mylohyoid muscle. The incision was closed completely except for a thin rubber drain which was removed at the end of 24 hours.

The patient's postoperative course was completely uneventful.

TISSUE EXAMINATION—Grossly the specimen consisted of a yellow, relatively soft, ovoid mass which measured 2.5 by 2 by 1 cm. When sectioned it was found that the cut surface was white, moist and homogeneous.

Histologic examination revealed a roughly circular, circumscribed mass of tumor tissue. At the periphery was a thin connective capsule. External to the capsule, normal mucous acini with serous demilunes were seen (Fig. 2, left). In the central portion of the specimen there were spindle and stellate epithelial cells which were generally separated one from the other by dense, hyalinized connective tissue (Fig. 2, right). The pattern in the subcapsular region was quite different. Here the epithelial component was predominant. The epithelial cells in this region were round or oval and close together (Fig. 2, left). The cells throughout the tumor stained quite uniformly. No evidence of malignancy was noted.

The microscopic diagnosis was benign mixed tumor of accessory salivary gland, floor of the mouth.

DISCUSSION—This case is recorded because it is unusual to find a mixed tumor in an individual so young, and because it is rare at any age to encounter such a lesion located superficially in the floor of the mouth.

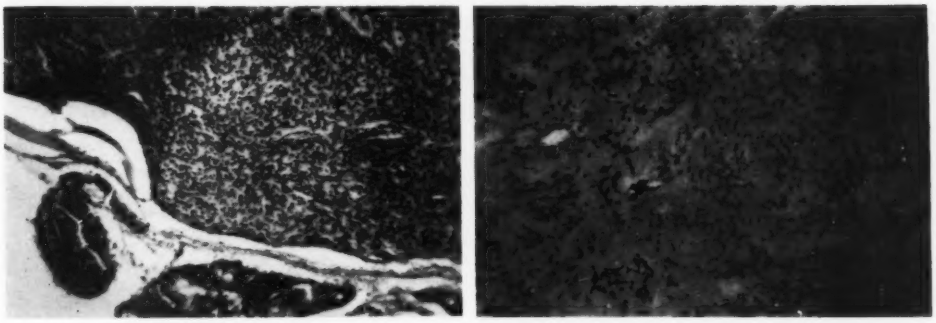

Fig. 2—Left: Periphery of specimen. At bottom is normal salivary gland tissue. Proceeding upward there is next a clear area containing a stringlike structure, the connective tissue capsule. The remainder is neoplasm, and its cellularity in this area is readily apparent. Right: Central portion of lesion showing haphazardly arranged spindle cells separated by bands of acellular dense connective tissue

Lymphocytosis with abnormal cells and the generalized lymphadenopathy suggested infectious mononucleosis with the possibility that the oral mass might be a component.

Fibrosing salivary retention cyst (ranula), dermoid cyst, branchial cleft cyst, sialolithiasis, and chronic sialadenitis were also considered. The immediate preoperative diagnosis was lipoma. The possibility of a mixed tumor of salivary gland origin was almost immediately ruled out because of the age of the patient and the location and consistency of the lesion.

■ IGNORANCE OF SCIENCE

It is inconceivable that we shall continue to understand either ourselves or our relations with one another if the educated people of our time remain in their present ignorance of the nature and the progress of science.—*Julius A. Stratton.*

Simultaneous carcinoma of upper and lower lip: *report of case*

■ *Frederick T. Wigand, D.D.S., M.S., Jacksonville, Fla.*

Approximately one third of all caricinomas of the skin are carcinomas of the lower lip[1] which in turn occur nearly 20 times as frequently as carcinomas of the upper lip.[1] Seldom does one patient have epidermoid carcinoma of both the upper and lower lips. Dr. Charles S. Cameron,[2] medical and scientific director of the American Cancer Society, states that he is unable to find any reference to simultaneous cancers in the upper and lower lip and quotes Martin,[3] who states: "In the past 35 years I have seen literally thousands of lip cancers and don't recall ever having seen simultaneous growths on the upper or lower lip in the same patient."

The case reported here is of interest in that it demonstrates such simultaneous growths and also the value of early detection and treatment of malignant lesions in the circumoral region.

REPORT OF CASE—A 35 year old white boatswain's mate first class. U. S. Navy, reported to the oral surgery service of the U. S. Naval Hospital, Jacksonville, Fla., on August 13, 1955, with the complaint of "dry lips."

The patient stated that he first noticed the unusual condition of his lips in January 1955. At that time he consulted a dentist and was advised to use a "chap stick" and to return in three months for further observation. Shortly thereafter he went to sea and was unable to return for observation until the visit mentioned herein. There was no history of serious illness or operations. He smoked two thirds of a package of cigarettes a day. He had served 16 years in the Navy, nearly all of which had been spent aboard ship in tropical waters.

PHYSICAL EXAMINATION—The patient was a well developed, red-haired, ruddy complexioned 35 year old white man. His general health was good with no abnormalities other than the condition of his lips. The lower lip was slightly swollen and the mucous membrane covering it was abnormal from scar tissue and crusts. On the right side of the lip at the mucocutaneous border there was a superficial ulcer approximately 0.5 cm. in diameter. The upper lip was normal except for a small nodule 3 mm. in diameter, located to the left of the midline at the mucocutaneous junction (Fig. 1, left). The lesion was ulcerated in the center and a thin discharge was noted. There was no evidence of lymphadenopathy or lymphadenitis in the submental or cervical regions.

LABORATORY DATA—Blood studies revealed leukocytes, 14,000, and hemoglobin, 15 Gm. The differential leukocyte count was neutrophils, 64; lymphocytes, 26; monocytes, 2; eosinophils, 8. The hematocrit was 45 per cent. Bleeding time was 2 minutes 45 seconds and the coagulation time was three minutes. The results of the serologic examination were negative. Urine studies were within normal limits.

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Captain, Dental Corps, United States Navy. U.S. Naval Hospital.

1. Bell, E. T. A textbook of pathology, ed. 6. Philadelphia, Lea & Febiger, 1948, p. 368-369.

2. Personal communication.

3. Martin, Hayes. Diagnosis of early cancer of the mouth. CA, Bull. of Cancer Progress 3:149 July 1953.

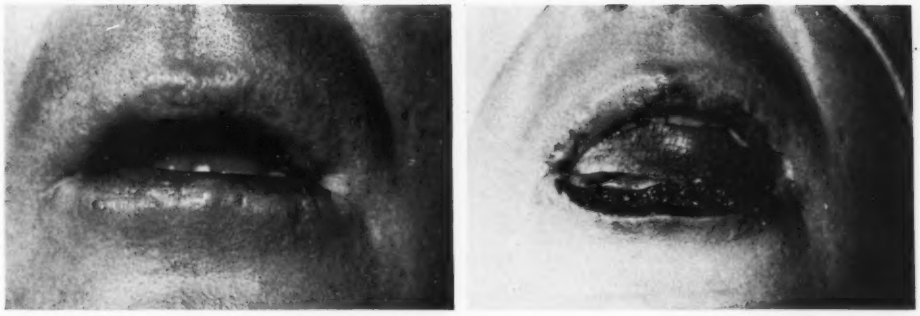

Fig. 1—Left: Appearance of upper lip prior to surgery. Right: Diseased mucous membrane removed from lower lip and mucous membrane on inner aspect of lower lip undermined

The impression was that the condition was hyperkeratosis of the lower lip and epithelioma of the upper lip.

TREATMENT—On August 15, under lidocaine hydrochloride-epinephrine local anesthesia, biopsies were taken from the most representative regions of the lesion of the upper lip and the lesion on the right side of the lower lip. These were sent to the pathology laboratory for microscopic examination.

The biopsy specimens were reported as: upper lip, squamous cell carcinoma, well differentiated; lower lip, leukoplakia.

FIRST OPERATION—On August 29, after inducing local anesthesia with lidocaine hydrochloride-epinephrine, a cheilotomy was performed to remove the hyperkeratotic tissue from the lower lip (Fig. 1, right). The wound was covered with a sterile dressing under moderate pressure. The elipse of tissue removed at operation was sent to the pathology laboratory for histologic examination.

POSTOPERATIVE COURSE—The first postoperative day the lower lip was slightly swollen. The patient was comfortable and had no complaints. The reparative process proceeded normally, and within three weeks the excised region was completely healed.

The pathological report on the specimen submitted from the operation was as follows: "Gross: Specimen consists of a strip of skin measuring 8 cm. in length by about 1 cm. in width; there are three lesions noted in the skin—one, which is 1.5 cm. from one end of the skin, is a small irregularly-shaped, slightly papillary, whitish excrescence which measures about 3 mm. in diameter. There are also seen at the 2.5 and 5.0 cm. marks respectively, also distal from this one end, two puckered, scarred areas; the one at the 5.0 cm. mark has a slight brownish crust over it; the sections containing the lesions are excised, fixed and imbedded. Sections are labeled A, B and C respectively.

"Microscopic: Section (A) shows skin with atrophy of the epidermis and a prominent layer of hyperkeratosis. There is no evidence of malignancy. Section (B) shows skin with changes essentially similar in all respects to that described above. Section (C) shows skin in which there are areas of epidermal atrophy and also some areas of acanthosis and elongation of the rete pegs. In one place there is a downgrowth of squamous cells in the form of low-grade squamous cell carcinoma. The localized area of malignancy is completely and widely excised. The diagnosis is leukoplakia of lower lip with focus of squamous cell carcinoma, widely excised" (Fig. 2).

The patient was presented to the tumor board of the hospital on September 23, for consideration of the squamous cell carcinoma of the upper lip. The board recommended surgical excision of the malignancy.

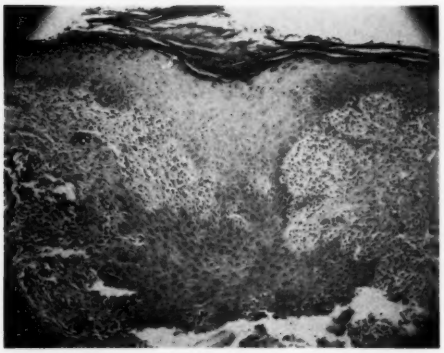

Fig. 2—Focus of squamous cell carcinoma, lower lip

Fig. 3—"V" incision around upper lip lesion

On September 30, under lidocaine hydrochloride-epinephrine anesthesia, the neoplasm of the upper lip was excised. A wide full-thickness "V" excision around the region of malignancy was done (Fig. 3). The excised lesion was sent to the pathologist for establishment of diagnosis and evaluation of adequacy of excision. A light application of petrolatum and a sterile dressing under moderate pressure were placed over the wound.

POSTOPERATIVE COURSE — The dressing was removed from the lip on the first postoperative day. The initial reparative processes were satisfactory. All sutures were removed by the sixth postoperative day.

The pathologist's report on the operative specimen was as follows: "Gross: Specimen consists of a wedge-shaped excision of lip measuring up to 1.2 cm. from apex to base (the base of the wedge is the vermilion border of the lip). Adjacent to the vermilion border there is an ill-defined centrally located slightly raised, opaque, whitish area measuring 3 mm. in diameter. The specimen is sectioned into multiple full width transverse sections to show the nearest lateral margin of excision. Microscopic: Sections reveal an ulcerated lesion in the middle of a plaque of epidermal thickening; in this lesion there is anaplasia, mild apolarity and atypia, with abortive pearl formation. The lesion is confined to the upper reaches of the dermis and appears to be completely and widely excised. No evidence of vascular invasion or of deep dermal invasion is noted. There is a marked dermal reactive lymphocytosis. The diagnosis is squamous cell carcinoma, Grade II" (Fig. 4, left).

Robert A. Colby,[4] Dental Corps, U. S. Navy, oral pathologist at the Naval Dental School, National Naval Medical Center, viewed the histologic sections from both lip lesions and concurred with the diagnoses.

Healing of the postoperative wounds progressed by first intention. Two weeks after final surgery, only minimal scars were present (Fig. 4, right). The upper and lower lips were satisfactory both as to function and appearance. The patient was considered locally cured. He was discharged from the hospital on a limited duty status and was examined each month for a period of six months. During this time, there was no evidence of recurrence or lymphatic involvement. He was restored to full duty. He will continue to be observed at monthly intervals.

COMMENT—A patient was seen who had simultaneous carcinomas of both the upper and lower lips. Such an occurrence is extremely rare and has not been previously reported in the literature. It is interesting to note that the original biopsy of the lower lip did not disclose

4. Personal communication.

Fig. 4—Left: Squamous cell carcinoma, upper lip. Right: Appearance of lips two weeks after final surgery

the presence of malignancy. Although the biopsy specimen was taken from the most suspicious appearing region, the pathological diagnosis was leukoplakia. When the entire hyperkeratotic vermilion border of the lower lip was removed, the microscopic examination revealed a low-grade squamous cell carcinoma. The initial biopsy was not definitive in that it did not tell the complete story. This illustrates the principle that in dealing with precancerous lesions, it is a much better procedure to remove the entire growth in toto rather than to leave it undisturbed or to treat it conservatively after receiving a biopsy report which is negative for evidence of malignancy. Other regions of growth, not touched by the biopsy, may show malignancy characteristics, as was illustrated in this case.

The five year cure rate for lip cancer in primary lesions of less than 2 cm. in diameter is calculated to be 92 per cent.[3] To attain this high percentage, it is necessary that the lesion be recognized early, that there be no lymph node involvement, and that the primary lesion be completely removed. In the case reported herein, the primary lesions were less than 2 cm. in diameter when detected, there was no evidence of lymphadenopathy, and the primary lesions were completely and widely excised. It is reasonable to assume, therefore, that the prognosis in this instance is favorable for permanent cure.

■ Interpretation of Scientific Facts

It is a telling comment that the Hall of Fame in science contains the names of a few men who discovered scientific facts, but a host who made these facts significant by pervasive and integrating explanation and interpretation.—*Henry Margenau.*

Carcinoma in a healing alveolus after a dental extraction: *report of case*

■ *Wilbur N. Van Zile, D.D.S., St. Albans, N. Y.*

The occurrence of a malignant neoplasm in a healing dental alveolus after a routine extraction procedure in a young healthy individual without dental or oral disease is a lesion that certainly is unusual and completely unexpected. In such an instance the proliferating malignant tissue may resemble the "proud flesh" of infected granulation tissue. Incorrect diagnosis and treatment based on such an appearance would result in the loss of valuable time in establishing the correct diagnosis and instituting proper treatment. A patient who suffered such a malignant lesion came under the care of the writer and this report is presented with the hope that it may stimulate early biopsy investigation whenever suspicious tissue develops in a healing alveolus after dental extraction.

REPORT OF CASE—A 19 year old white man was admitted to the sick list at an overseas military dispensary on November 11, 1955, with a diagnosis of pyogenic granuloma in the maxilla. He was transferred into a Naval hospital on November 14 where a diagnosis of carcinoma, squamous cell, of the maxillary gingiva was established by biopsy examination. The patient was transferred immediately to a Naval hospital in the United States for definitive treatment where he arrived on November 22.

HISTORY OF THE LESION—The right maxillary lateral incisor had been fractured on September 1 while the patient was eating, and the root fragment was extracted several days later because it was painful. He was very positive in stating that there had been no swelling about the tooth before the traumatic incident. Swelling in the region had been noticed first by the patient on October 28 but he had delayed for several days before returning to the dispensary where the extraction was accomplished. The lesion had not responded to treatment (unknown) and he was then transferred into the Naval hospital where the diagnosis was established.

PHYSICAL EXAMINATION—On arrival of the patient at a Naval hospital in the United States on November 22, the oral examination revealed a granular, fungating lesion of the gingival tissues of the right maxilla (Fig. 1, left) that appeared to be limited labially to the region of the healing alveolus where the lateral incisor had been extracted (Fig. 1, center). The lesion extended onto the palate about 1.0 cm. beyond the region of the alveolus (Fig. 1, right). During a six day period of observation before treatment, the lesion was seen to be enlarging with alarming speed. All remaining oral tissues were in excellent health.

There were no general physical findings of significance except that a single lymph node was palpable in the superior deep cervical chain. All laboratory studies were within normal limits.

Intraoral and extraoral roentgenographic examinations of the maxillae and other bones of the face revealed no evidence of neoplastic invasion.

TREATMENT PLAN—The patient was presented for consultation with the hospital tumor committee. A review of the original biopsy slide

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Captain, Dental Corps, United States Navy, U.S. Naval Hospital.

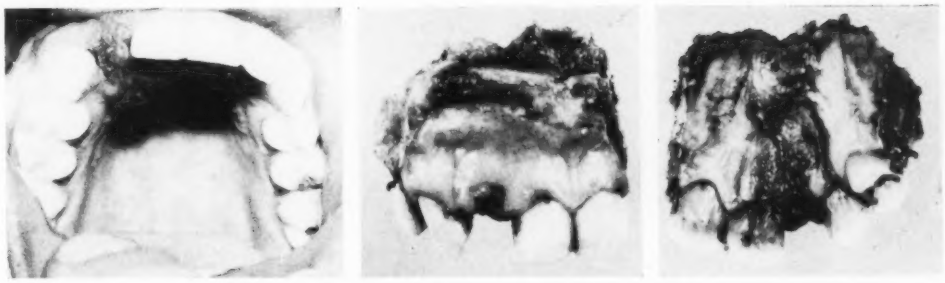

Fig. 1—Left: Carcinomatous lesion which developed in a healing alveolus. Center: Excised portion of maxilla. The lesion appears to be limited labially to the alveolus. Right: Carcinoma appeared to be expanding rapidly through palatal mucosa

showed the tumor to be well differentiated in character and unlikely to respond to radiation therapy without danger of osteoradionecrosis. It was decided that treatment should consist of a surgical block resection of the right maxilla sufficiently radical to encompass the lesion with at least 1.0 cm. margins of normal tissue to be followed with radiation at a later date in the event of recurrence. It was the concensus that the single palpable lymph node in the superior deep cervical chain was probably based on an earlier inflammatory incident since metastasis was unlikely from the anterior maxillary region in such an early stage of gingival carcinoma.[1]

SURGICAL PROCEDURE—The operation was accomplished under thiopental sodium-nitrous oxide-oxygen anesthesia on November 28. Vertical mucoperiosteal incisions were made from the gingival crests overlying the right second bicuspid and the left lateral incisor teeth and were carried to the height of the buccal and labial tissue reflection. Tissue flaps were elevated and the alveolar bone overlying the indicated teeth was removed with chisel and mallet and the teeth were extracted.

A horizontal mucoperiosteal incision was then made just beneath the anterior nasal spine to connect the superior extremities of the two vertical incisions and the bone was exposed. The vertical bone cuts were connected transversely at the level of the anterior nasal spine using a Stryker vibratory bone saw to cut well through the cortical bone plate.

The palatal tissues were incised in a similar manner and the cortical bone again sectioned with the Stryker saw. All cuts were deepened with chisel and mallet until the entire fragment of the maxilla could be removed. Hemorrhage was controlled with hot packs and electrocoagulation.

After excision, a 1.5 cm. bony defect was seen in the antral floor. Examination of the antrum revealed it to be clear and normal. Mucosa of the lip and palate was mobilized to close the defect and the exposed bone that remained was covered and packed with sterile gauze saturated with bacitracin ointment.

Postsurgical orders included penicillin, dihydrostreptomycin and adequate sedation. The operated region granulated and epithelized uneventfully (Fig. 2). A temporary denture was placed ten days after surgery to prevent tissue contracture at the denture periphery.

REPORT OF PATHOLOGIST—The pathologist's gross examination was reported as follows: "The specimen consists of a fresh portion of maxilla measuring $4.0 \times 3.0 \times 2.0$ cm. and contains four teeth. The right lateral incisor has been previously extracted. On the gingival mucosa in this area is a raised somewhat fungating lesion that is more prominent on the palatal

1. Ward, G. E., and Hendrick, J. W. Diagnosis and treatment of tumors of the head and neck. Baltimore, Williams & Wilkins Co., 1950, p. 267.

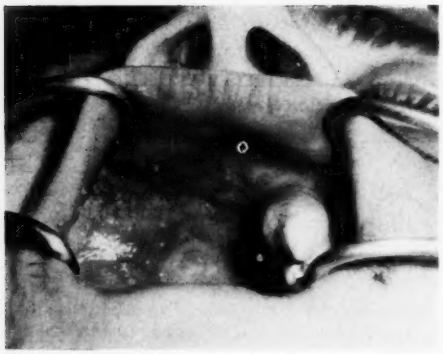

Fig. 2—Operated region two months after surgery

mucosal surface with a raised rolled border (Fig. 1, right). A section through the alveolus of the previously extracted right lateral incisor reveals the alveolus to be filled with gray pink neoplastic appearing tissue, which seems to be projecting through the overlying mucous membrane and presenting a cauliflower-like appearance. Three areas will be sectioned for study: (1) a vertical section will be made through the alveolus in a labiopalatal direction; (2) a section will be taken at right angles to the first section from the medial side of the alveolus to include the root of the central incisor; and (3) a vertical section in a buccopalatal direction will be taken through the root of the bicuspid."

The microscopic examination was reported as follows: "Section 1 shows normal gingival mucosa covering the labial and palatal surfaces. However, as the study progresses along the labial surface there is a point of gradual transition from normal squamous epithelium into squamous cell carcinoma (Fig. 3, left). The carcinoma appears as a fungating mass containing numerous epithelial pearls, keratin hyaline granules and frequent mitotic figures. The bulk of the tumor has a well differentiated appearance, presenting a mosaic pattern. The tooth socket is filled with tumor which overhangs the palatal mucosa, there being a sharp transition between normal mucosa and carcinoma (Fig. 3, center). Sections 2 and 3 show no tumor. The diagnosis is squamous cell carcinoma arising from gingival mucosa involving a healing alveolus."

DISCUSSION—The lesion in this instance may be described as a common gingival squamous cell carcinoma, but the development of a vigorous gingival carcinoma in such a young person is not common, particularly when it would seem that the trauma from a routine extraction procedure may have been the triggering stimulus.

A search of the literature reveals no instance reported of primary carcinoma commencing in a healing alveolus after dental extraction, nor does the Registry of Dental and Oral Pathology of the Armed Forces Institute of Pathology have on record a case where carcinomatous changes have occurred in a dental alveolus during the healing process after extraction.[2]

In this instance it cannot be shown exactly where the carcinomatous activity first began, but the evidence would tend to support the theory that a traumatized gingival margin resulting from either the original fracture or the extraction was the probable site, with subsequent invasion of the organized blood clot. The facts indicating this are as follows: The patient was positive that there was nothing abnormal in the region of the lateral incisor at the time it was fractured nor for some time thereafter. There were no remarks in either the dental or medical records to indicate the possibility of a malignant lesion at the time of the extraction of the residual root. The carcinoma must have developed soon after the extraction as evidenced by the invasion of the alveolar blood clot by malignant squamous cells which prevented normal osteogenesis during the two month period between extraction of the tooth and excision of the carcinoma. The actual onset of the lesion in this instance is a moot question, but it illustrates the ever present possibility of malignant change in unexpected situations and the importance of early histologic examination when healing does not progress in a normal manner.

2. National Library of Medicine, personal communication. June 6, 1958.

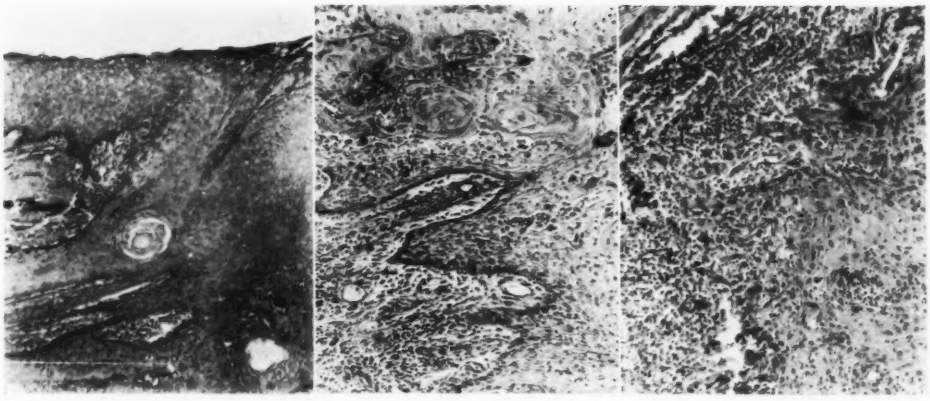

Fig. 3—Left: Section on labial margin where a gradual transition occurs from normal epithelium to squamous cell carcinoma. Center: Section on palatal mucosa where sharp transition occurs from normal epithelium to squamous cell carcinoma. Right: Sheets and strands of malignant epithelium could be followed deeply within the healing alveolus (arrows)

RESULTS—The patient has been followed regularly to date with no indication of recurrence of the carcinoma, and no metastases have developed. Normal functional and cosmetic relationships have been restored with a prosthesis.

SUMMARY—A young patient was treated for a squamous cell carcinoma which had developed unexpectedly in a healing alveolus after a dental extraction. The tumor originated from gingival epithelium that apparently had been stimulated to malignant activity by the trauma incidental to either fracture or extraction of a maxillary tooth. Treatment consisted of a partial block resection of the maxilla. The occurrence of carcinoma in a healing dental alveolus after extraction has not been reported previously.

■ Applied Science and the Future

Humankind cannot get grace from the gadgets introduced by science. In the bakelite house of the future, it seems possible that the dishes won't break, but the heart can.—*J. B. Priestley.*

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Journal of Oral Surgery assumes a new and more comprehensive title

THE TITLE OF THE JOURNAL OF ORAL SURGERY has been amended to include two fields of growing importance in dentistry—anesthesia and hospital dental service. This has been done to allow inclusion of a broader field of hospital dentistry in title as well as in fact. Actually, considerable material on anesthesia has always been published and some articles on other facets of hospital dental service have also appeared on occasion. It is hoped that in the future, the scientific material can be so balanced and so integrated as to produce an outstanding journal which will encompass the broad field of hospital dentistry, including oral surgery, anesthesia and other hospital dental services.

Although oral surgery is at present the dominant dental specialty in hospitals, it must be recognized that other dental services are required for fulfillment of the total patient care program to which the hospitals of the future are committed. It then necessarily follows that if dentistry is to assume its proper role in hospitals, it must be represented as a profession and not as a single specialty. Actually, the inclusion of other dental services will lend considerable authority to the oral surgery staff that might otherwise be isolated and without intraprofessional support. Only as broad dental service programs are developed in hospitals, will physicians and hospital administrators come to realize the importance and magnitude of the contributions dentistry is capable of making to the total health care of the public. We are hopeful that our new journal will stimulate interest in hospital dentistry and broaden our profession's effectiveness in the hospitals of the future.—*Fred A. Henny.*

Asepsis in minor oral surgical procedures: a re-evaluation

DENTISTRY has made tremendous strides in assuming the responsibilities of a mature and respected profession. This progress will continue, but any practice which might delay the achievement of greater stature must be subjected to critical review. Within the field of oral surgery, the area most vulnerable to such a review is the degree to which aseptic procedures are followed in daily practice.

Asepsis is the basis on which surgical technics are founded. To accomplish the aims of modern oral surgical technics, there must be exclusion (by asepsis), and destruction (by sterilization), of microorganisms which might contaminate the site of operation. It is obvious, therefore, that every oral surgeon must carry out in his clinical practice the exacting requirements which are demanded of him when operating in a hospital.

The premise that there is no necessity for precautionary preparations when the oral surgeon operates in a nonsterile field is fallacious. Witness the precautions taken by both the proctologist and the otolaryngologist in this regard. Medical literature contains many references supporting the necessity for taking the same care in preparing for minor operations that is required for major surgery. This includes the sterilization of instruments by autoclaving and the use of cap, mask, sterile towels, drapes, gowns and gloves.

Although the oral cavity cannot be rendered sterile, methods should be employed which will prevent the introduction of foreign organisms into the field of operation. Natural immunity and the use of various antibiotics prevent infection in many instances, but there is no substitute for a sound aseptic technic in any surgical procedure, no matter how minor. In their routine clinical practice, many dedicated men are conscientiously adhering to this concept. They have found that with well-trained, efficient assistants, the utilization of such a technic (gloves, mask, cap) in minor oral surgical procedures, including exodontics, is not unduly time-consuming, costly or complicated. The reward in greater protection for the patient and in added prestige for the dental profession is extremely gratifying.

Dentistry, as a profession, has autonomy in charting its own destiny. However, it still remains an affiliate of medicine as a science and art dealing with prevention, cure or alleviation of disease. Dentists are presently negotiating with their colleagues in the medical profession for recognition as a major health service in hospitals. Our professional standards in oral surgery must parallel those of medicine if we are to acquire equality.

No surgeon, regardless of his field, can expect to be accepted as an equal in a medical-dental organization unless he is adequately qualified and is imbued with the ideals and basic principles of surgery. Oral surgeons must think them, live them and use them in the daily routine—not hold them in reserve for special occasions.—*Ralph W. Taylor, Rear Admiral, Dental Corps, U. S. Navy.*

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

■ Persistent Paresthesia

Q.—I am writing to ask your opinion on a case. A white woman, aged 41, has a disagreeable paresthesia on the right side of the mandible which began after the removal of a third molar eight years ago. I have seen the patient for the past five years and her status has remained about the same. Roentgenograms continue to show a break in the continuity of the canal but show no conclusive evidence of a neuroma. The symptoms are peripheral to the site of the injury. What treatment, if any, would you suggest in a case of this type?—*J.L.W.*

A.—Two problems may arise after the inferior alveolar nerve has been injured during the removal of a mandibular third molar—anesthesia and paresthesia. From a practical standpoint, one must realize that in the majority of instances, normal sensations will return in time though the patient initially has complete anesthesia followed by various stages of paresthesia, which by definition, is a perverted or abnormal sensation. When there is postoperative numbness of the lower lip, recovery can be expected in a period of several weeks to several months, depending on the degree of injury.

Occasionally, however, either complete anesthesia or a perverted sensation will persist for an indefinite period, and the chances of recovery are diminished the longer the condition prevails.

If there is complete anesthesia in this instance it can be concluded that the nerve was severed at the time of surgery and the cut ends sufficiently displaced to prevent union.

As you suggested, a neuroma also might be suspected, particularly if there is still a radiolucent area in the region of the third molar. Another cause of persistent anesthesia is the rapid build-up of dense bone between the proximal and distal portions of the nerve which would prevent union because of obliteration of the canal.

If, on the other hand, there is a perverted sensation present, then it can be assumed that partial union has taken place since some nerve stimuli are being transmitted. A neuroma is a possibility, but when present it usually produces symptoms at the site of injury rather than peripherally. The most likely condition prevailing in this instance is minimal union of the nerve fragments with scar tissue surrounding and impinging on the nerve.

The chances of producing a satisfactory result by means of neurorrhaphy or decompression if the condition has persisted for eight years are, of course, limited, particularly if there is complete anesthesia. The distance between the nerve endings is probably too great to get apposition. However, if there are some sensations being transmitted, success is possible, particularly if the causative factor is either soft tissue scar or sclerotic bone. The site of injury can be exposed intraorally by reflecting a large mucoperiosteal flap and removing the cortical bone to expose the inferior alveolar nerve. The nerve should be released from its surroundings and a new canal produced if necessary. The patient should be advised of the problems involved and should not be overly optimistic considering the length of time she has had the problem.

This section devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners is edited by S. Elmer Bear, Department of Oral Surgery, Medical College of Virginia, Richmond, Va., to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor.

■ The technic of surgically altering the position of impacted maxillary cuspids has limitations related to the development of the root, degree of impaction and available space for the crown. Even though it may be concluded that the vitality of the tooth cannot be preserved, consideration still should be given to a modification of the technic in order to utilize the cuspid.

When orthodontic procedures are contraindicated for reasons of economics or accessibility, the technic of replantation of the cuspid may prove satisfactory. The impacted cuspid is exposed through use of a palatal flap and gently removing bone by means of a chisel rather than a bur since this preserves the crown of the cuspid. The tooth is removed in toto, and a root canal filling is inserted immediately. A small portion of the apical portion of the root is excised to provide more room when replanting the tooth. The crown is then contoured to fit the space and it may be necessary to construct a socket for the root with burs and chisels. The tooth can be wedged firmly between the lateral incisor and first bicuspid slightly above the occlusal plane. The soft tissue flaps are repositioned and generally there is no need for any other means of fixation.

This technic appears to have particular value in instances in which the cuspid must be removed and there is space available in the arch. Though the percentage of success is amazingly high, failure of the replanted tooth to hold is not too disturbing since no damage has been done by the procedure and much may be gained by its success.

■ The field of oral surgery is being plagued by some of the same problems found in other specialties; namely, antibiotic resistant microorganisms. The problem is becoming more prevalent in oral surgery cases, particularly those involving open reduction of the mandible.

New antibiotics are being tried in an effort to control these resistant organisms. One such drug is kanamycin sulfate (Kantrex), which is considered to be very effective against a wide variety of gram-positive and gram-negative pathogens including a strain of *micrococcus pyogenes* var. *aureus* which may be resistant to other antibiotics. It is bactericidal in action and is generally recommended only when other clinically acceptable antibiotics have failed in the treatment of "problem" infections.

The drug may have some value where the resistant organism has produced wound infections, abscesses, persistent cellulitis or osteomyelitis. It may be administered either orally or intramuscularly, though the former route is not indicated except in intestinal infections. The intramuscular dosage for adults is 1 to 2 Gm. in two to four doses daily, and in children 15 to 30 mg. per kilogram of weight in two to four equally divided doses.

The degree of toxicity has not been fully determined though there is no evidence of cardiovascular, liver or hematopoietic damage. There has been evidence of dermatitis and, in the intramuscular administration, renal irritation has been noted. Cases of eighth nerve damage including tinnitus, vertigo and temporary loss of hearing have been reported. These conditions are thought to be reversible should they occur. Since kanamycin sulfate is a new antibiotic it should be administered only under strict supervision, with frequent laboratory studies to evaluate the patient for complications; this can perhaps best be effected with the patient hospitalized.

Readers are nvited to send their clinical observations to S. Elmer Bear, Department of Oral Surgery, Medical College of Virginia, Richmond, Va.

■ DIGEST OF PREPAID DENTAL CARE PLANS 1958. By Walter J. Pelton, D.D.S., M.S.P.H., and Richard W. Bowman, A.B., Division of Dental Resources, Public Health Service. Printed revision and expansion of Mimeographed digest for 1957. 46 pages. Public Health Service Publication No. 585. U. S. Department of Health, Education and Welfare, Washington D. C., Government Printing Office, 1958.

Growing interest of the American people in insurance against cost of dental service was reflected in heavy demand by dental organizations and consumer groups for the Mimeographed edition of this digest issued in 1957. The information, therefore, was brought up to date for the 1958 edition. The new, printed publication includes brief summaries of 83 prepaid dental care plans and covers all major plans of this sort sponsored by unions, employers, or fraternal groups as of March 1958.

The plans are divided into two principal classifications: (1) those offering "regular prepaid dental benefits," including all plans that provide any type of unrestricted restorative service; and (2) those offering "limited prepaid dental benefits," including plans that do not provide any restorative services, those that provide only limited indemnity for such services, or those that provide them as reduced fee benefits at established charges to the subscriber. Under the two main classifications, the plans are subdivided into four groups according to sponsorship: (1) communitywide; (2) union; (3) employer-employee, and (4) fraternal. The table of contents constitutes an index of plans, listed alphabetically under the two main headings and four subheadings.

Facts on topics such as areas served, type of benefits, methods of operation, number of enrollees, eligibility, benefits, exclusions, costs, and fees are succinctly stated for the individual plans in easily scanned outlines in which the main headings are set in bold-faced type. Fee schedules of four plans operating in California, Oregon, Washington State, and New York City are detailed in a four-page appendix table.

The clear, attractive typography and orderly arrangement of the handbook invite repeated use. Five blank pages at the back provide space for memoranda.—*Robert A. Downs.*

■ MUSCLE RELAXANTS IN ANESTHESIOLOGY. By Francis Foldes. 210 pages with 20 illustrations. $5.50. Springfield, Ill., Charles C Thomas, 1957.

This text is accurately described by its title. It covers the various naturally occurring relaxants, such as d-tubocurarine, and the synthetically obtained ones, such as succinylcholine; the theory of their biochemical actions is discussed and also illustrated by a series of excellent diagrams. There are sections on the different clinical aspects of the drugs: their dosages, their methods of administration, their antagonists, their contraindications, and so forth. There is an added amount of material on the use of muscle relaxants outside the field of anesthesia, describing their use in the treatment of tetanus and in the diagnosis of neuromuscular disorders.

The book is scholarly. It reveals no partisan animus; it is fully documented with footnotes and a bibliography of 400 references. A persistent (and successful) stylistic effort has been made throughout to have the subject appear no more intricate than need be. Since the field of oral surgery and the field of muscle relaxants in anaesthesiology have a few important points in common, the oral surgeon will be interested to find these points well covered in the present book.—*Sam Houston Brock, Jr.*

Announcements

■ International Academy of Oral Pathology Formed

With a goal of greater interchange of knowledge and concepts between peoples of different nations, the International Academy of Oral Pathology has been formed.

Fifty Fellows will ultimately constitute the entire organization and membership in the Academy will be by invitation. A founding group of seven internationally known oral pathologists have accepted Fellowship in the Academy and are actively engaged in the discussion of procedural policies.

Joseph L. Bernier, chief of oral pathology, Armed Forces Institute of Pathology, Washington, D. C., will serve as secretary and will, from time to time, announce further activities of the organization.

■ New Course Offers Medico-Dental Correlation

A completely new course, "The Medical Laboratory in Clinical Dentistry" will be presented at the Michael Reese Hospital Center, Chicago, February 12-13 immediately following the Mid-Winter meeting of the Chicago Dental Society.

This course, which is a medico-dental correlation in relation to diagnosis and treatment of oral disease, will be conducted by Emanuel Cheraskin, professor and head of the department of oral medicine, University of Alabama, and Arthur Elfenbaum, professor emeritus, University of Illinois and Northwestern University, and in charge of the diagnostic division, department of dentistry, Michael Reese Hospital.

The fee for the two-day course is $35. Further information may be obtained from the Dental Department, Michael Reese Hospital, 29th St. at Ellis Ave., Chicago 16.

■ Two and Three Year Courses in Oral Surgery at Illinois

Applications are now being accepted by the College of Dentistry of the University of Illinois for two and three year full time courses in oral surgery beginning in September 1959. Both programs carry credit toward a master of science degree.

Details concerning the courses may be obtained from Daniel M. Laskin, department of oral and maxillofacial surgery, University of Illinois, 808 S. Wood St., Chicago 12.

■ Refresher Course in Anatomy of Head and Neck

A five-day course in the anatomy of the head and neck will be given March 16-20, 1959, at the School of Dentistry, Medical College of Virginia, Richmond, under the direction of Alton Brashear.

The course will include a dissection of the head and neck regions by course participants, and clinical application to problems in oral surgery and prosthodontics will be emphasized.

The fee is $75 and the class is limited to ten. Application should be made to H. T. Knight, director of graduate and postgraduate studies, department of dental research, Medical College of Virginia, Richmond, Va.

■ Applications for Fellowships Invited

The American Academy of Oral Pathology announces that the examination for elevation to Fellowship in the Academy will be held April 17, 1959, at the University of Minnesota, Minneapolis.

Applications, which must be received before January 1, may be obtained from Robert J. Gorlin, secretary-treasurer, American Academy of Oral Pathology, School of Dentistry, University of Minnesota, Minneapolis 14.

■ Advanced Oral Pathology Class Scheduled at Minnesota

Advanced oral pathology will be offered in a five-day refresher course at the University of Minnesota April 20-24, 1959. The course consists of both lectures and laboratory.

Course registration is limited to 15 individuals and the fee is $65. Housing for the five days will be approximately $15.

Interested individuals should contact Robert J. Gorlin, chairman, division of oral pathology, School of Dentistry, 242 Owre Hall, University of Minnesota, Minneapolis 14, Minn.

■ Graduate Oral Surgery Course at University of Kansas

A three-year course in oral surgery is offered in conjunction with Kansas City General Hospitals and the Kansas City Veterans Administration Hospital by the University of Kansas City School of Dentistry.

The programs, designed to meet the requirements of the American Board of Oral Surgery, begin July 1. Applications should be on file by January 1 with the director of graduate training at the university.

The school also announces that two rotating internships are offered in conjunction with the Veterans Administration Hospital of Kansas City, Mo., and the Veterans Administration Hospital of Wadsworth, Kan. More information may be obtained from James P. Darnell, Chief of the Dental Section, Veterans Administration Hospital, Kansas City, or Dayton D. Krajicek, Chief of the Dental Section, Veterans Administration Hospital, Wadsworth, Kan.

■ V. A. Hospital in Memphis Has Openings

The Veterans Administration Medical Teaching Group Hospital of Memphis, Tenn., announces that one rotating dental internship and one residency in prosthodontics will be available for the year beginning July 1959.

Information and application forms may be obtained from the chief of the dental service, Veterans Administration Medical Teaching Group Hospital, Memphis, Tenn.

■ Fifth National Dental Congress in Cuba

The Fifth National Dental Congress of the Colegio Estomatologico Nacional of Cuba will be held March 29-31 at the Casa De La Cultura on Avenida de los Presidentes and calle Tercera, Vedado, Havana. Information regarding the meeting may be obtained from the Colegio Estomatologico Nacional, Calle L 353, Vedado, Habana, Cuba.